Maryland Upper Potomac River

Final Version for 1985-2002 Data
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Tidal Monitoring and Analysis Workgroup
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Maryland Upper Potomac River Basin Characteristics

Maryland's Upper Potomac River Basin is the largest in the State and drains 2,050 square miles of land including all of Allegany and Washington Counties and parts of Montgomery, Frederick, Carroll, and Garrett Counties. Larger water bodies include the Potomac, North Branch Potomac, and Monocacy Rivers, and Catoctin, Antietam, Conococheague, Town, Wills, and Georges Creeks. There are numerous lakes in the basin, including Seneca Lake (the largest), Lake Habeeb, Savage River Reservoir, and Jennings Randolph Reservoir. The basin lies in the Appalachian Plateau Province, the Ridge and Valley Province, the Blue Ridge Province, and the Lowland Section of the Piedmont Plateau Province.

The census population for the basin in 2000 was 462,000. Major population centers in the basin include Frederick, Hagerstown, Cumberland, Westminster, and Green Valley.

The predominant land use in the Upper Potomac River Basin is classified as forested (48 percent). Agricultural land is the second largest land use at 38 percent. Approximately 14 percent of the basin is classified as urban land (Figure UPR1).

A series of Best Management Practices (BMPs) have been planned in the basin to help reduce non-point source pollution. As of 1998, the implementation of these practices varies from having exceeded the goal to not having made any progress. Implementation of BMPs for animal waste management, conservation tillage, cover crops, and stream buffers have made good progress toward Tributary Strategy goals. Unfortunately, there has been no progress in forest harvesting BMPs, which consist of regulatory and voluntary measures applied to timber harvests, including erosion and sediment control and streamside management. Others, such as nutrient management and stream protection have exceeded the goals.

There are 18 major (design flow of half a million gallons per day or greater) and 76 minor wastewater treatment plants in the basin. (The Nicodemus plant has been decommissioned and flow is now diverted to the Conococheague facility.) Eight of the major wastewater treatment plants have already implemented biological nutrient removal (BNR). Seven other major plants plan to implement BNR by 2005. The remaining three major plants have not planned to implement BNR. The locations of major and minor plants are shown in Figure UPR2. Appendix A contains graphs of nutrient loads from the basin's major wastewater treatment facilities.

According to the model, nitrogen loadings to the Upper Potomac decreased from 10.23 million pounds to 8.92 million pounds from 1985 to 2002. The most significant contributor of nitrogen to the Upper Potomac Basin is still agricultural sources (56 percent) followed by point sources (18 percent). Total nitrogen load contributions by source for 1985 and 2002 are shown in Figure UPR3.

The model predicts reductions in total phosphorus of 320,000 pounds between 1985 and 2002. Decreased loads from phosphorus came primarily from point source reductions and from agriculture. Presumably, point source reductions in phosphorus resulted from the statewide ban on phosphates in detergents in 1986. Agriculture is the largest contributor of phosphorus loads to the basin (59 percent). This is followed by point sources (22 percent). Total phosphorus load contributions by source for 1985 and 2002 are shown in Figure UPR4.

Sediment loads to the basin have increased from 1985 to 2002. Agriculture is the dominant sediment source (80 percent). Sediment load contributions by source for 1985 and 2002 are shown in Figure UPR5.

Overview of Water Quality and Monitoring Results

Water and Habitat Quality

Non-tidal Water Quality Monitoring Information Sources

Much useful information on non-tidal water quality is available on the Internet. The State of Maryland's Biological Stream Survey (MBSS) basin fact sheets and basin summaries are available at:
http://www.dnr.state.md.us/streams/mbss/mbss_fs_table.html
MBSS also reports stream quality information summarized by county at:
http://www.dnr.state.md.us/streams/mbss/county_pubs.html In addition to these reports and fact sheets, detailed and more recent information and data are also available on the MBSS website: **http://www.dnr.state.md.us/streams/mbss**

Find information on the Montgomery Countywide Stream Protection Strategy at:
http://www.montgomerycountymd.gov/siteHead.asp?page=/mc/services/dep/index.html

Information on biological, physical, and chemical water quality monitoring in Frederick County is available at:
http://www.co.frederick.md.us/npdes/h2oquality.html#Biological, Chemical and Physical Monitoring

Water quality information collected by Maryland's volunteer Stream Waders is posted at:
http://www.dnr.state.md.us/streams/mbss/mbss_volun.html

Long-term Water Quality Monitoring

Good water quality is essential to support the animals and plants that live or feed in the tributaries. Parameters measured include nutrients, algal abundance, total suspended solids, water clarity (Secchi depth), and dissolved oxygen.

Water quality in the Upper Potomac basin is highly variable. There are high quality trout streams, and there are streams smothered by acid mine drainage precipitates that support only algae and bacteria. Agricultural and urban sources of nutrients and sediments dominate the eastern Piedmont and Great Valley areas. Forested areas in the Ridge and Valley Province in the middle of the basin reduce agricultural and urban impacts to the edge of the Appalachian Plateau in the western basin where agricultural and urban impacts increase along with mining impacts.

Current status is determined based on the most recent three-year period (2000-2002). For dissolved oxygen, the current levels are compared to ecologically meaningful thresholds to assign a status of good, fair, or poor. Thresholds have not been established for the other parameters, so the current data are compared to a baseline data set, and assigned a status of good, fair, or poor, which is only a *relative* status compared to the baseline data. Long-term rends are determined using a non-parametric test for trend (the Seasonal Kendall test). For a detailed description of the methods used to determine status and trends, see http://www.dnr.state.md.us/bay/tribstrat/status_trends_methods.html.

There are 28 monitoring stations scattered about the basin. Total nitrogen concentrations declined (improved) at all but one station over the 1985-2002 period. Water quality status varied from poor to fair throughout the basin (Figures UPR6 and UPR7).

Total phosphorus decreased at only eight stations. With respect to phosphorus concentrations, most of the stations in the eastern part of the basin were poor, whereas the stations in the western part of the basin were good or fair (see Figures UPR8 and UPR9).

Total suspended solids were decreasing at a few stations and increasing at one station. Most stations showed no significant trend (Figures UPR10 and UPR11). Total suspended status varied throughout the basin.

Figure UPR1. Land Use in the Upper Potomac Tributary Strategy Basin.

Upper Potomac Basin Maryland Department of Planning Land Use (2000)

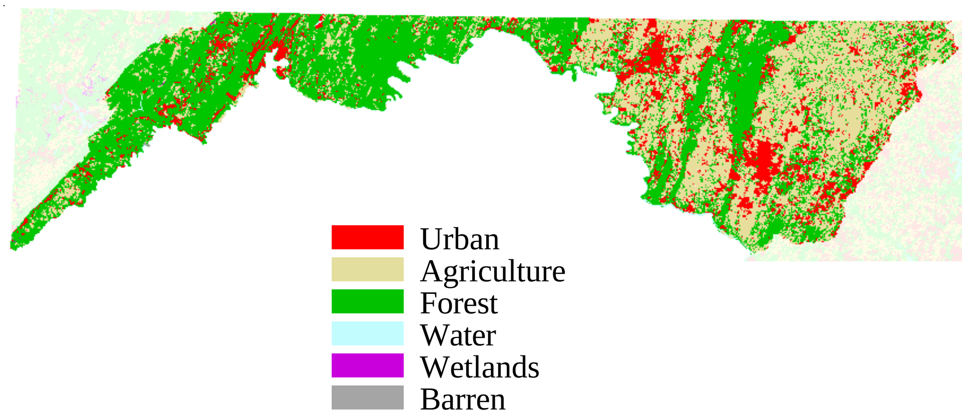


Figure UPR2. Major and Minor Wastewater Treatment Plants in the Upper Potomac Tributary Strategy Basin.

Upper Potomac Basin Wastewater Treatment Plants

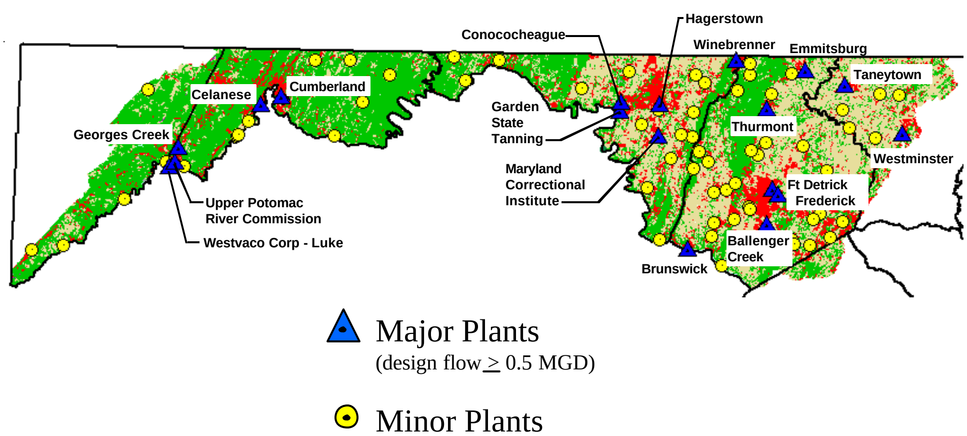


Figure UPR3. 1985 and 2002 Nitrogen Contribution to the Upper Potomac by Source.

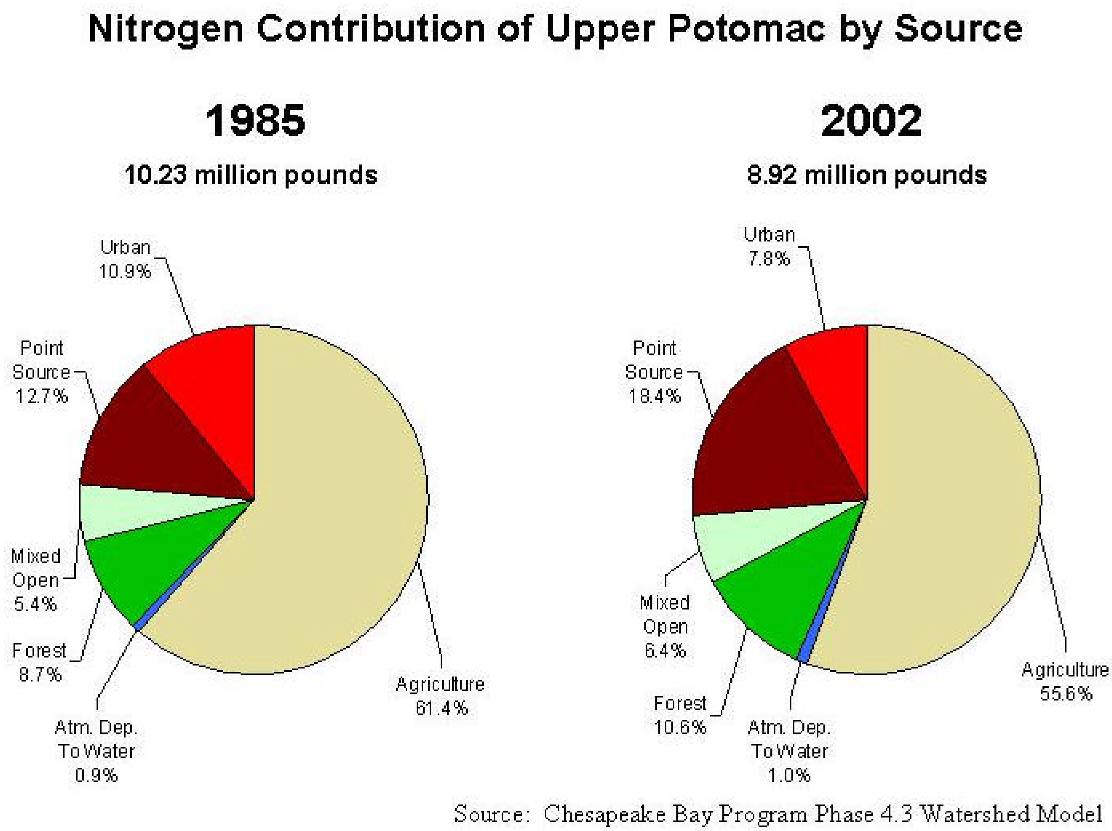


Figure UPR4. 1985 and 2002 Phosphorus Contribution to the Upper Potomac by Source.

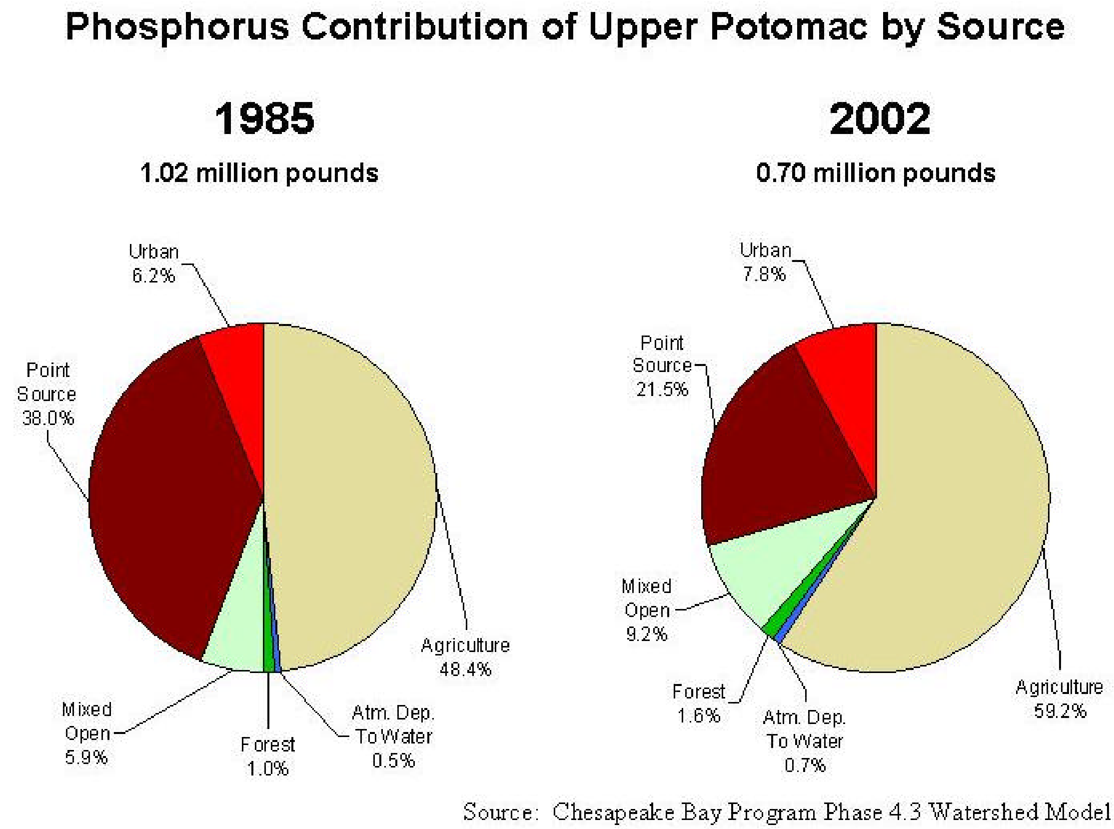


Figure UPR5. 1985 and 2002 Sediment Contribution to the Upper Potomac by Source.

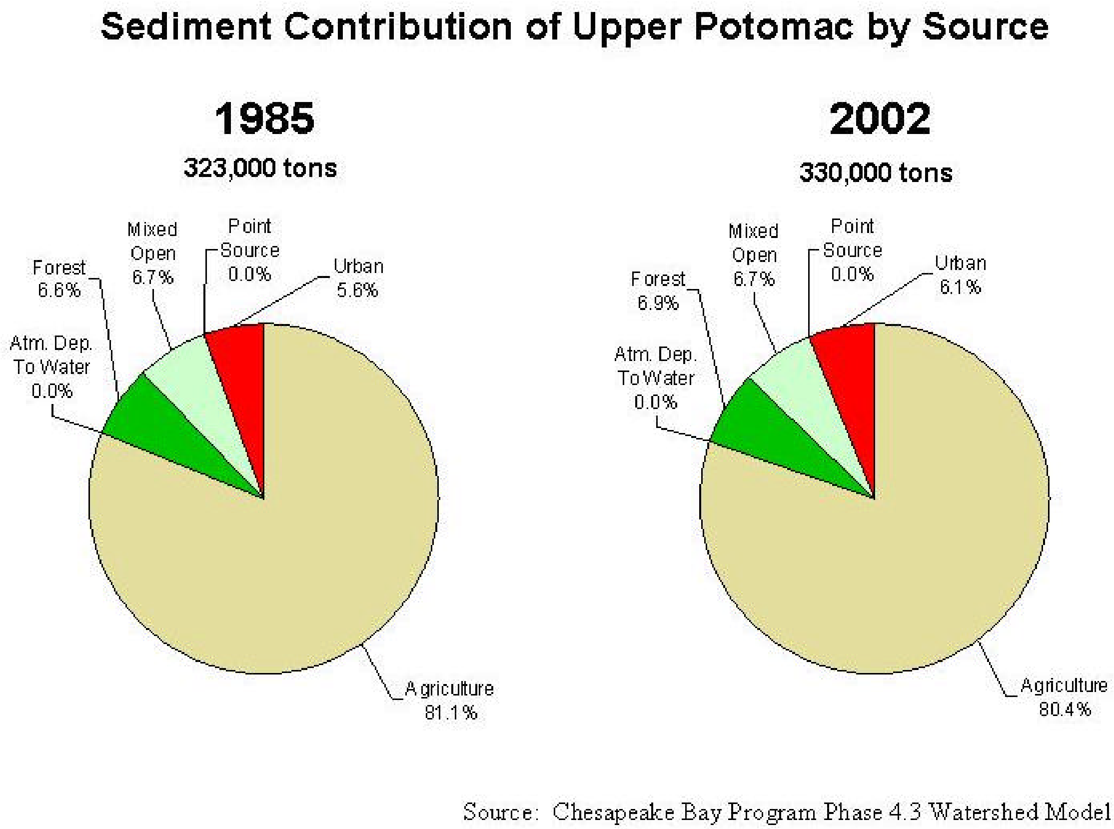


Figure UPR6. Total Nitrogen Status and Trends (Western Section).

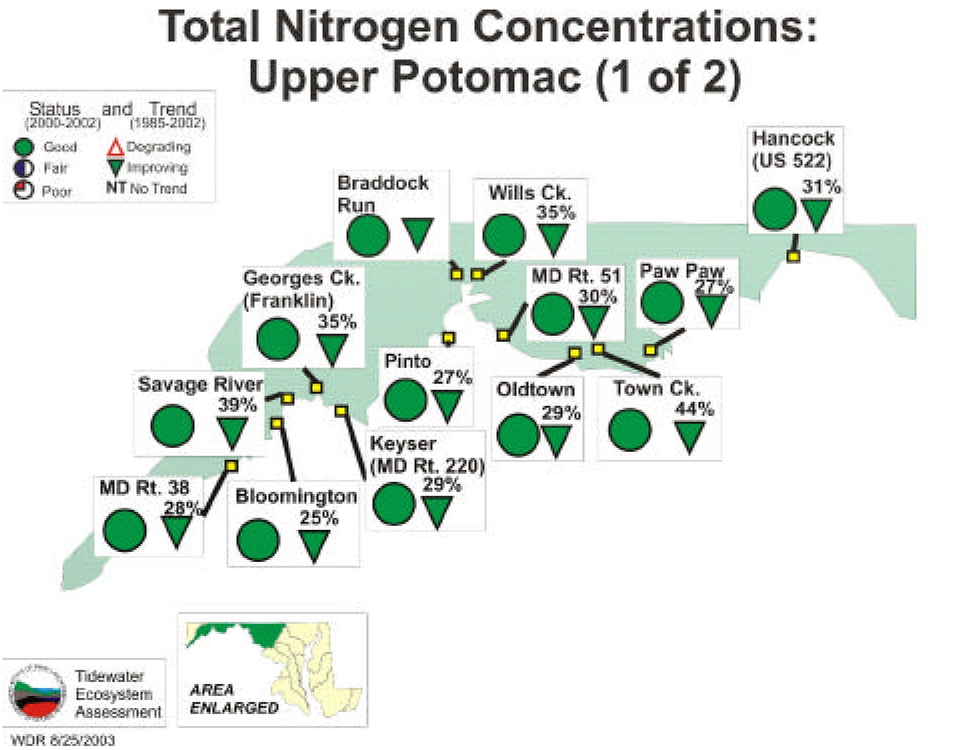


Figure UPR7. Total Nitrogen Status and Trends (Eastern Section).

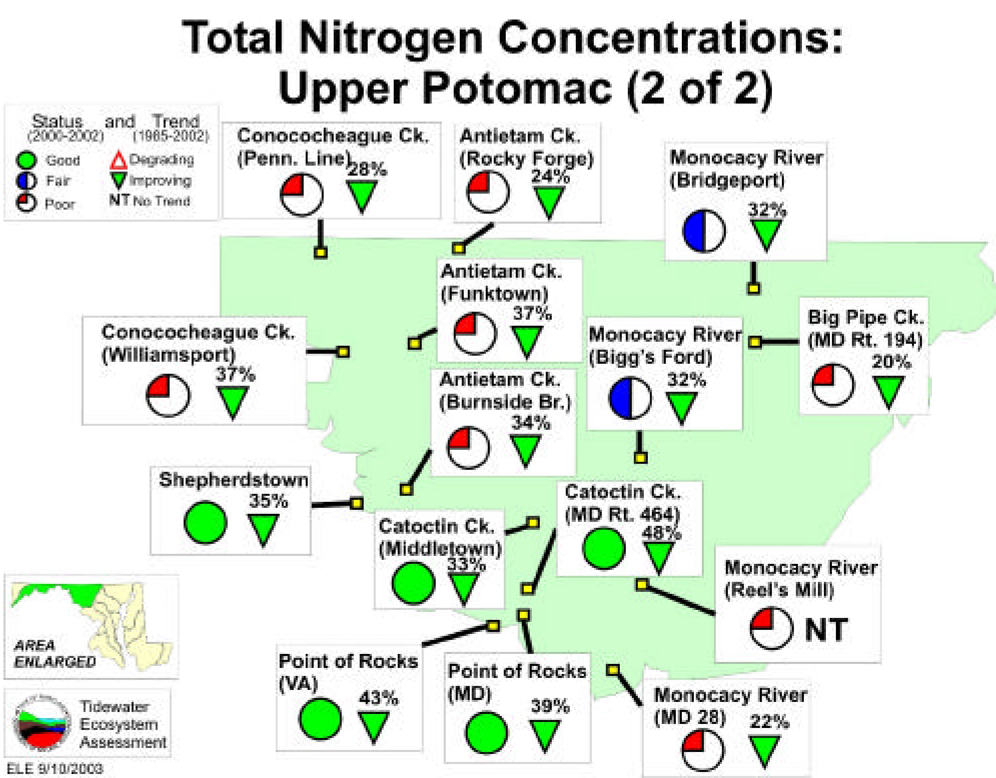


Figure UPR8. Total Phosphorus Status and Trends (Western Section).

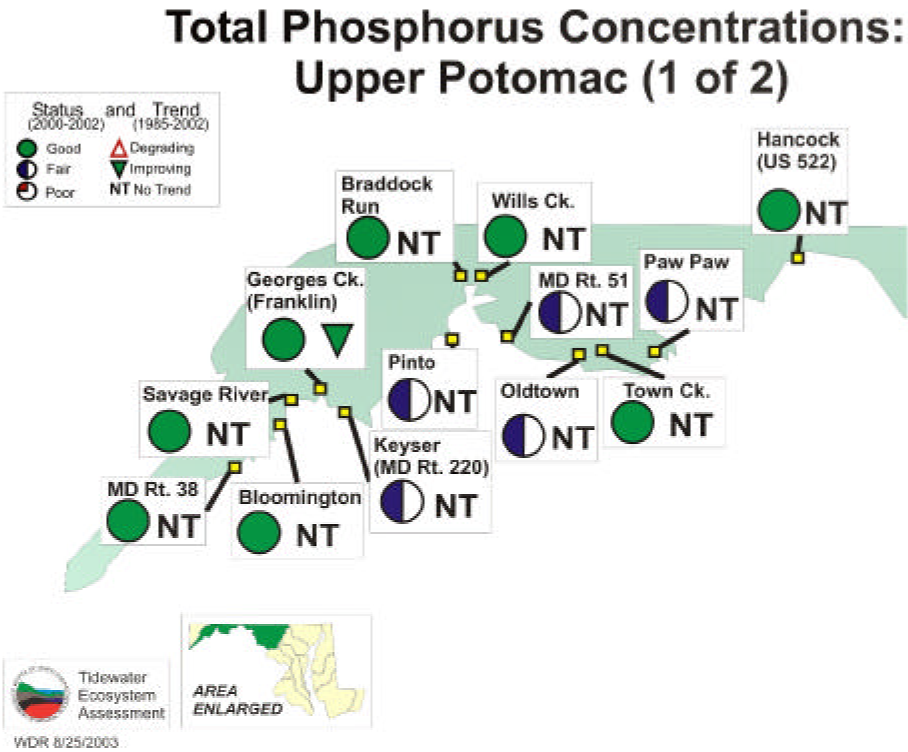


Figure UPR9. Total Phosphorus Status and Trends (Eastern Section).

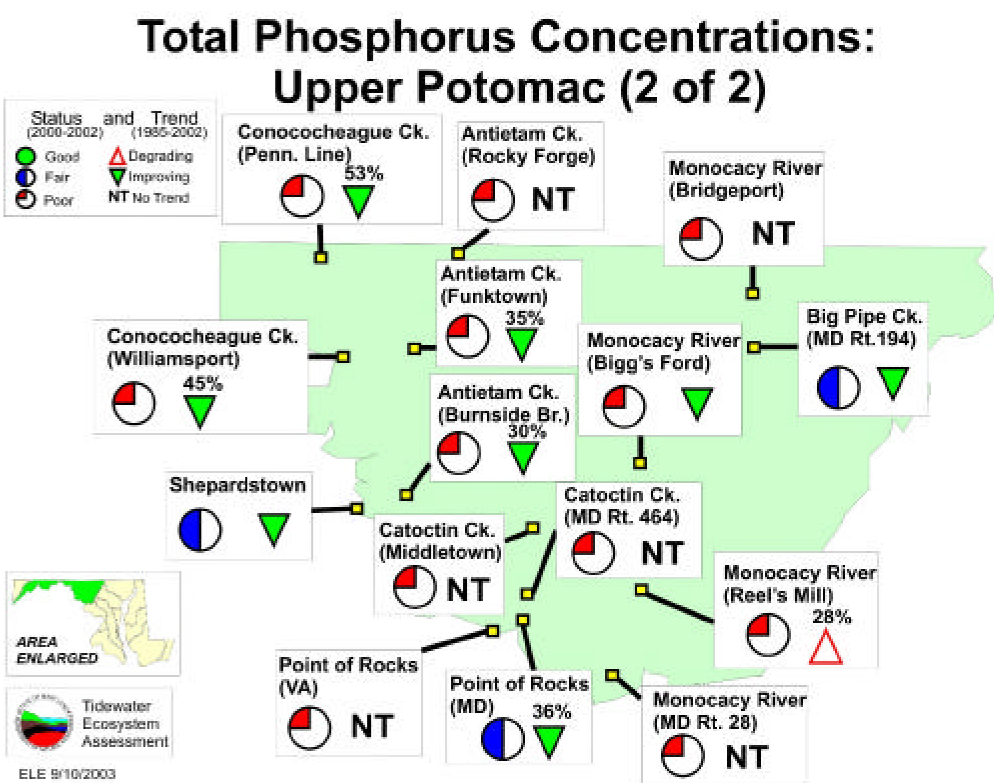


Figure UPR10. Total Suspended Solids Status and Trends (Western Section).

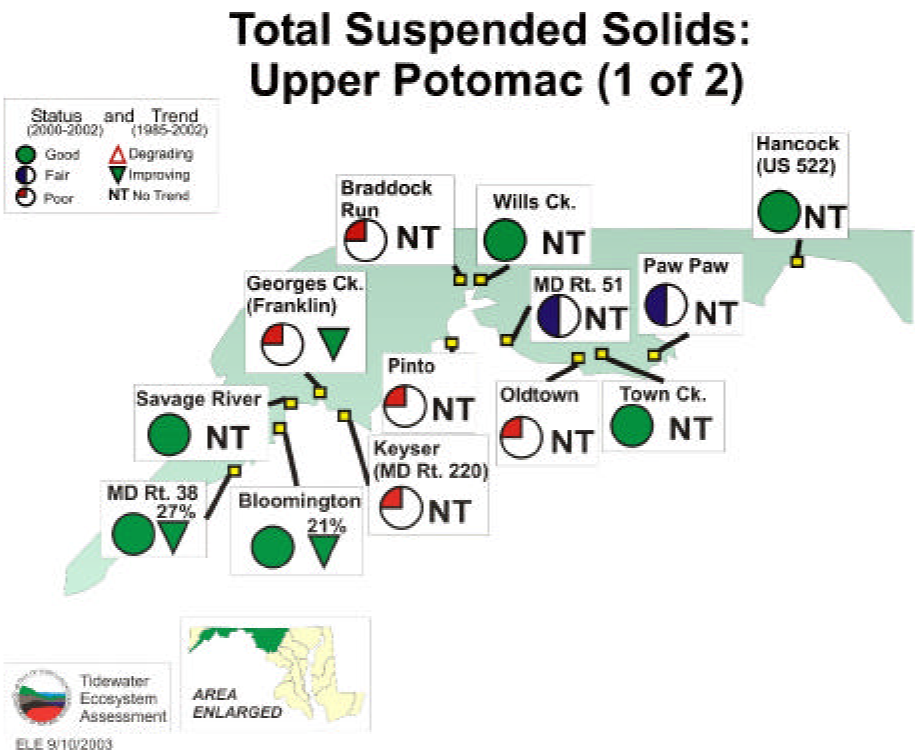
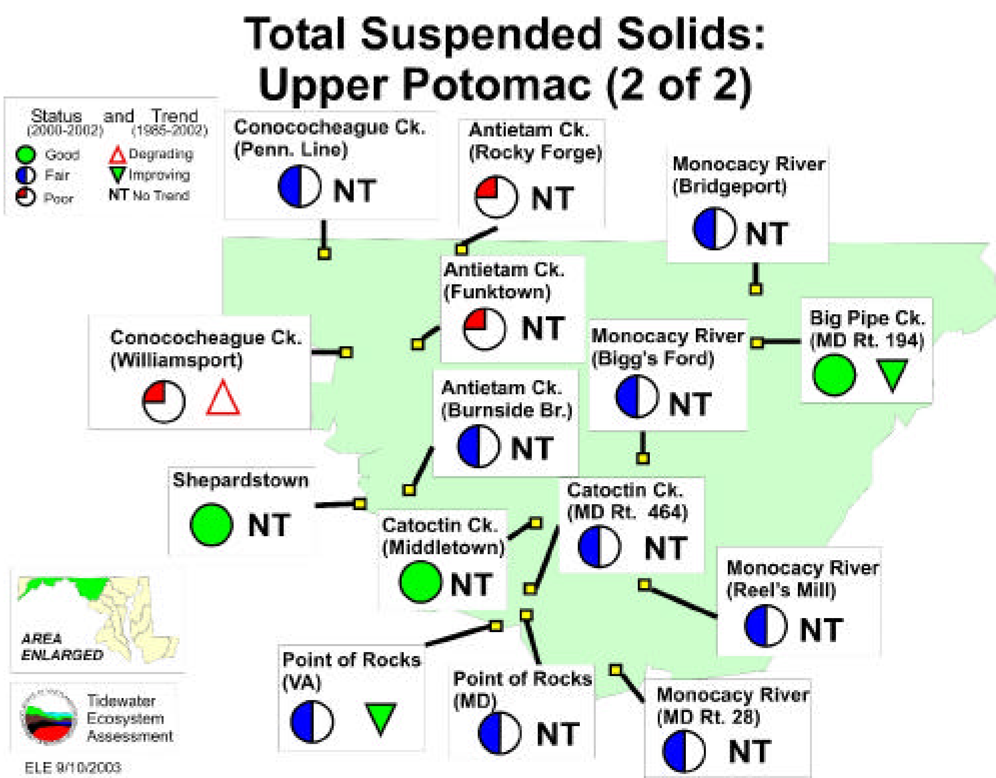


Figure UPR11. Total Suspended Solids Status and Trends (Western Section).



Appendix A – Nutrient Loads and Flows from Major Wastewater Treatment Plants

There are 18 major (design flow of 0.5 millions of gallons per day or greater) treatment plants in the Upper Potomac River basin. Figures A-1 through A-36 present the mean daily total nitrogen and total phosphorus loads and flows for these plants. Figures A-37 and A-38 show the percentage of total nitrogen and total phosphorus, respectively discharged by each major plant. Figures A-39 and A-40 show the mean daily total nitrogen and total phosphorus loads and flows for all major plants.

The Cumberland and Frederick plants account for nearly one-half of the total nitrogen load for the major plants at 25 and 24 percent, respectively. The Hagerstown plant discharges the next highest total nitrogen load at 15 percent (Figure A-37). Cumberland and Frederick also account for the highest percentage of total phosphorus at 21 and 26 percent, respectively. Hagerstown discharges the third largest amount of phosphorus at 18 percent (Figure A-38).

The total nitrogen load from all major plants rose from 5,063 lbs/day to a peak of 6,319 lbs/day in 1989. Since that time, total nitrogen loads had decreased to 3,888 lbs/day in 2002 despite and increase in flow from 51 millions of gallons per day to 62 millions of gallons per day (Figure A-39). The pattern of change in total phosphorus loads demonstrates the effectiveness of the mid-1980s ban of phosphates in detergents. Total phosphorus loads reached a peak of 1,512 lbs/day in 1985, dropped sharply to 951 lbs/day in 1986 and were 531 lbs/day in 2002 (Figure A-40).

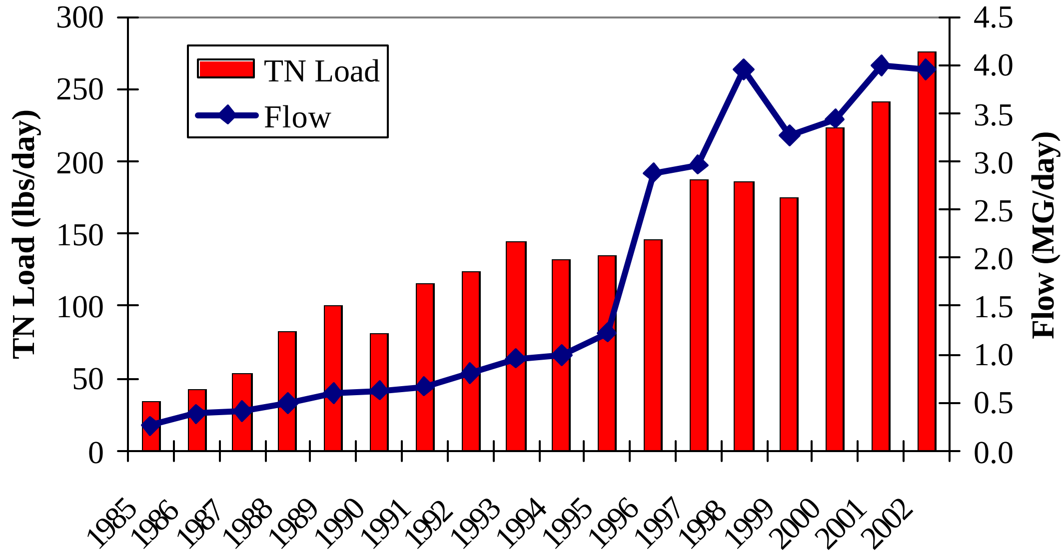


Figure A-1. Mean daily total nitrogen loads and flow for Ballenger Creek treatment plant.

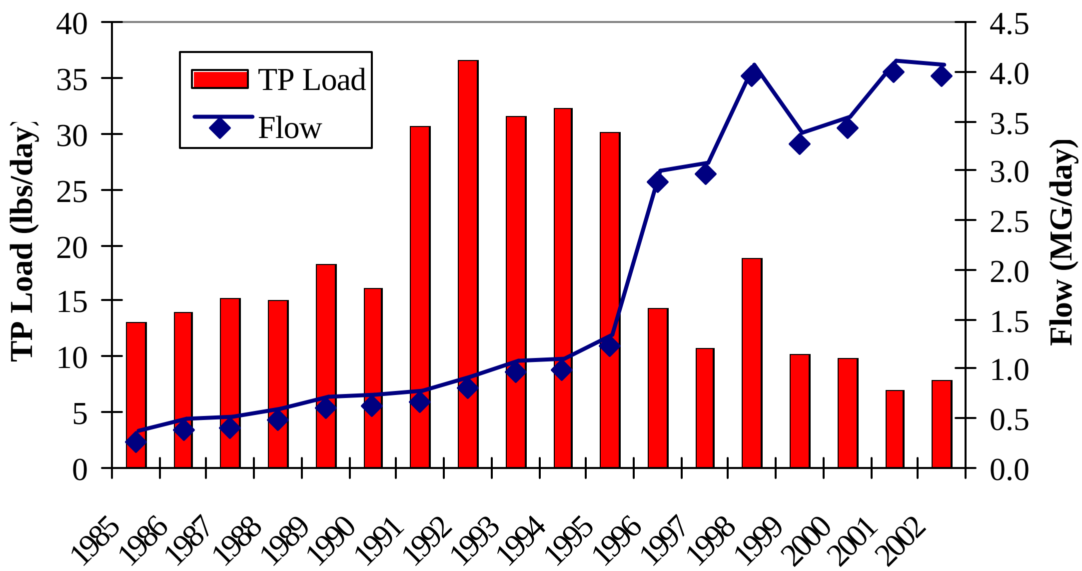


Figure A-2. Mean daily total phosphorus load and flow for Ballenger Creek treatment plant.

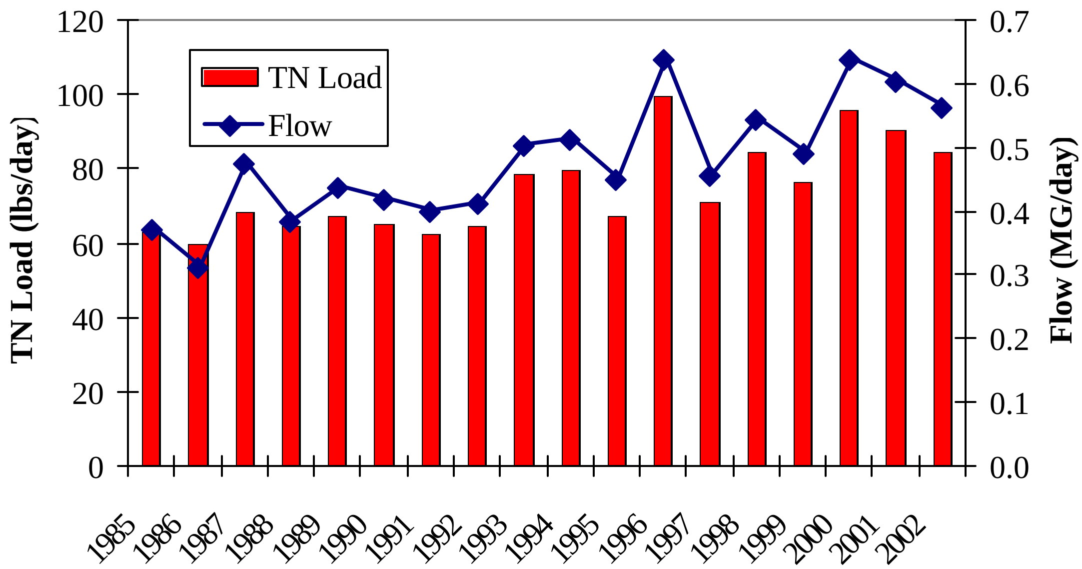


Figure A-3. Mean daily total nitrogen load and flow for Brunswick treatment plant.

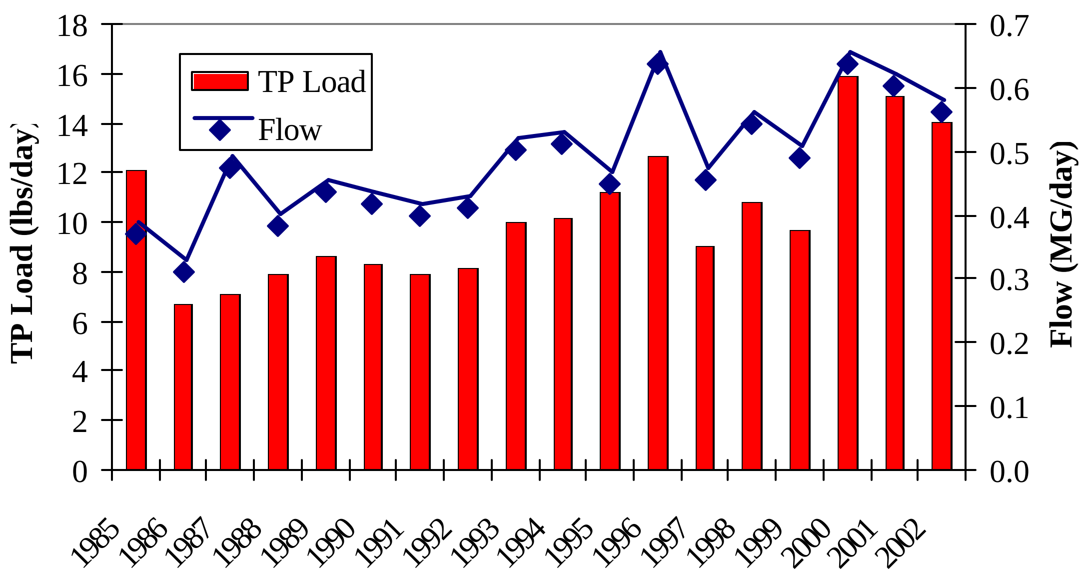


Figure A-4. Mean daily total phosphorus load and flow for Brunswick treatment plant.

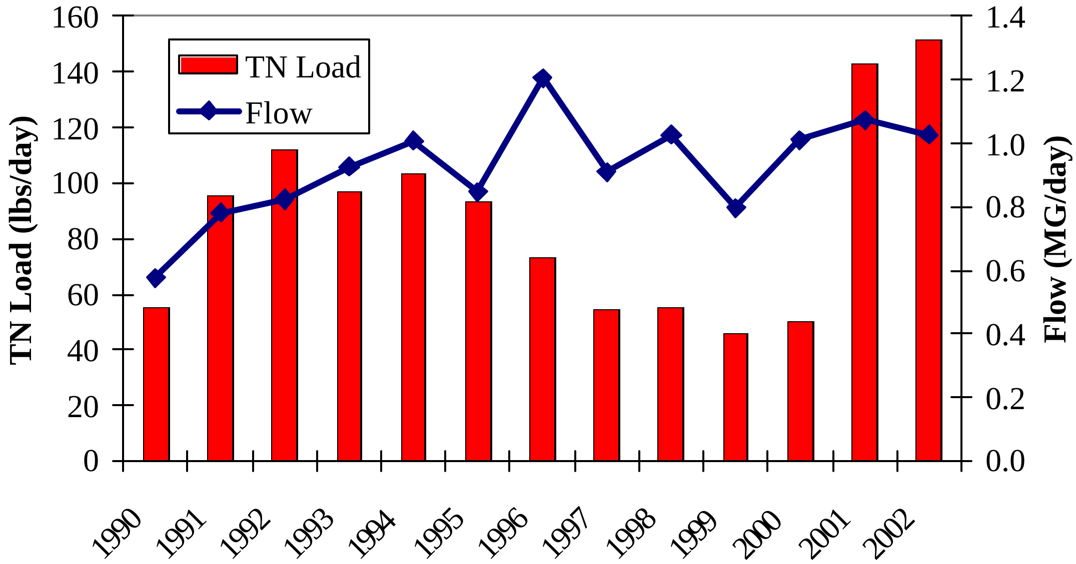


Figure A-5. Mean daily total nitrogen load and flow for Celanese treatment plant.

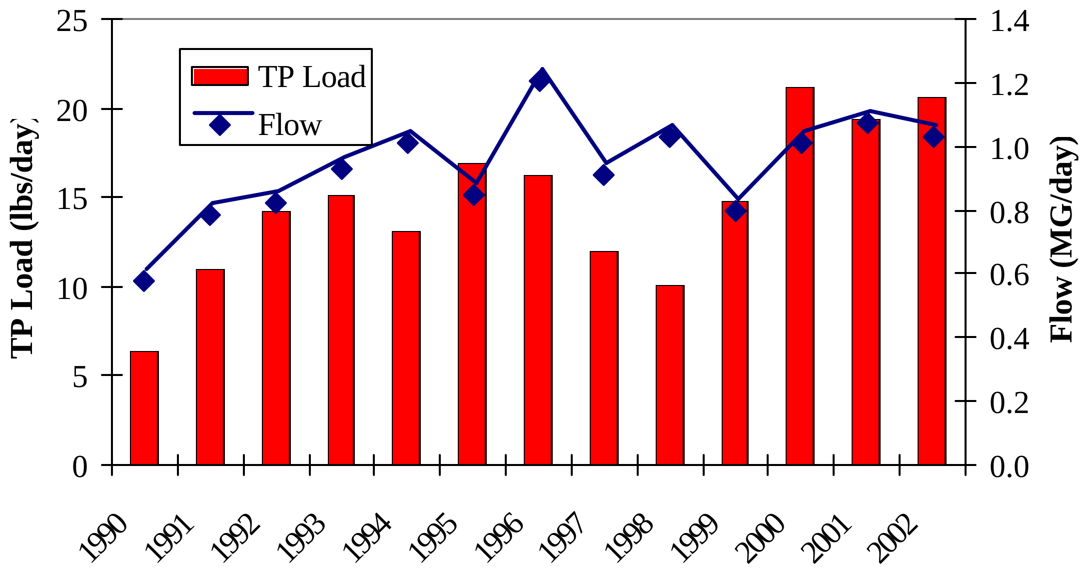


Figure A-6. Mean daily total phosphorus load and flow for Celanese treatment plant.

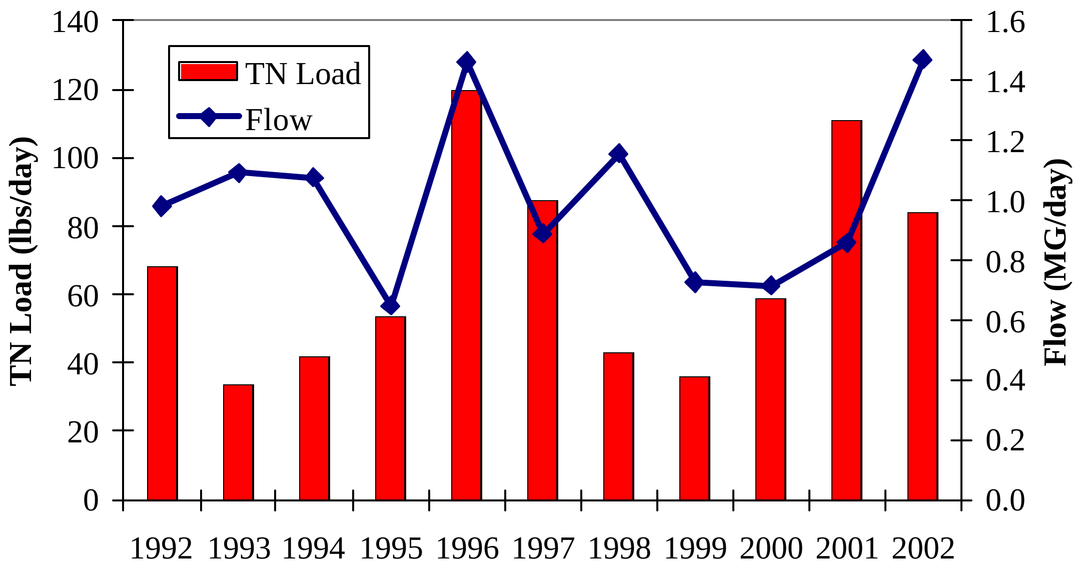


Figure A-7. Total nitrogen load and flow for Conococheague treatment plant.

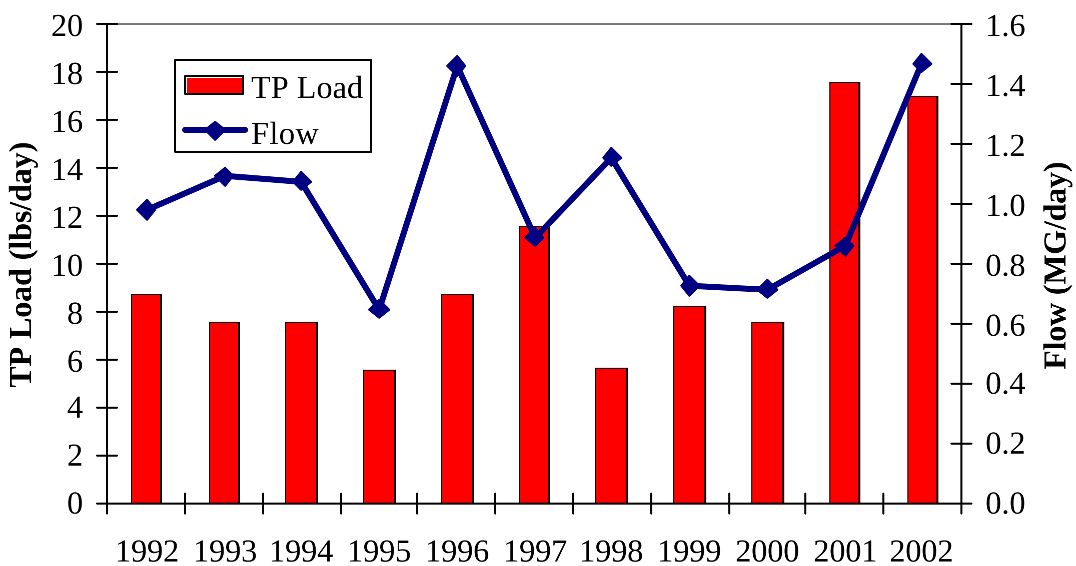


Figure A-8. Total phosphorus load and flow for Conococheague treatment plant.

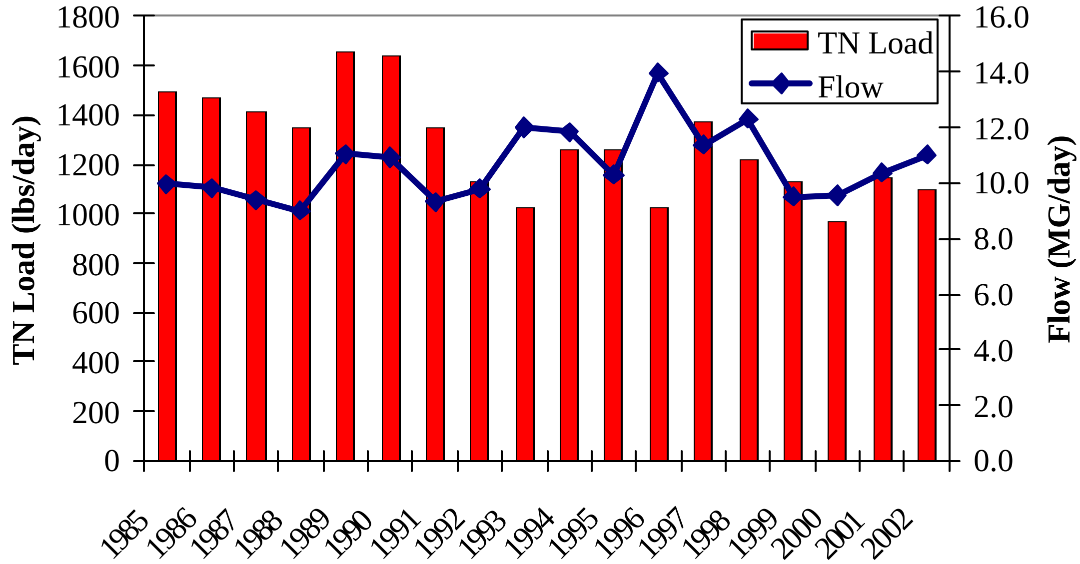


Figure A-9. Mean daily total nitrogen load and flow for Cumberland treatment plant.

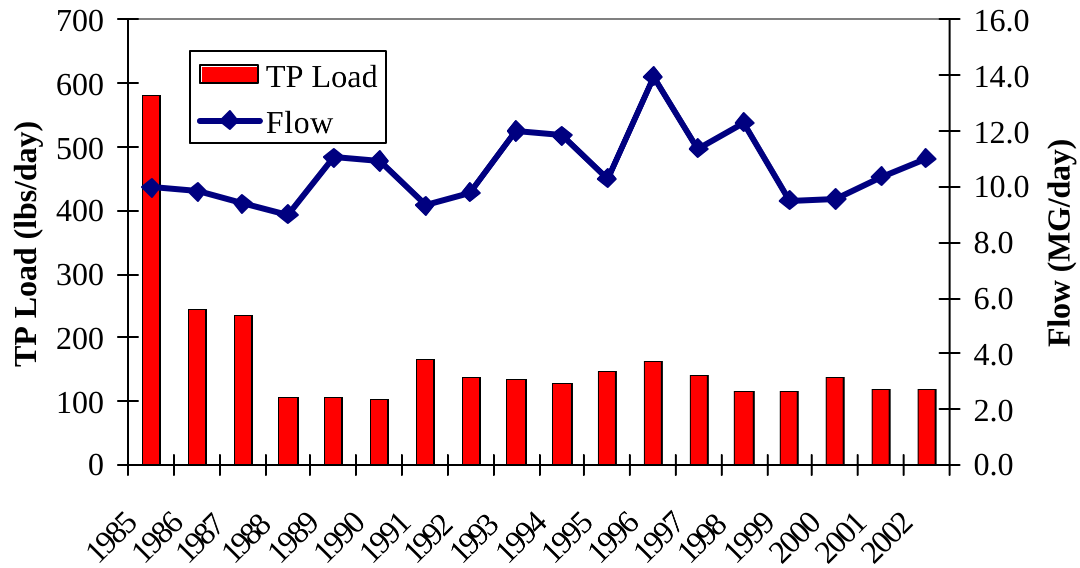


Figure A-10. Mean daily total phosphorus load and flow for Cumberland treatment plant.

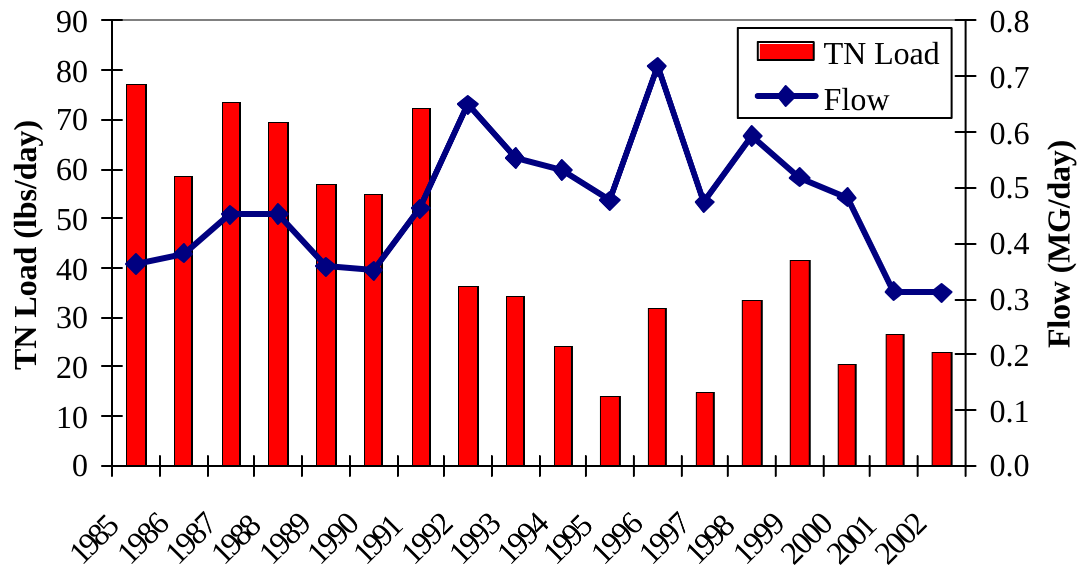


Figure A-11. Mean daily total nitrogen load and flow for Emmitsburg treatment plant.

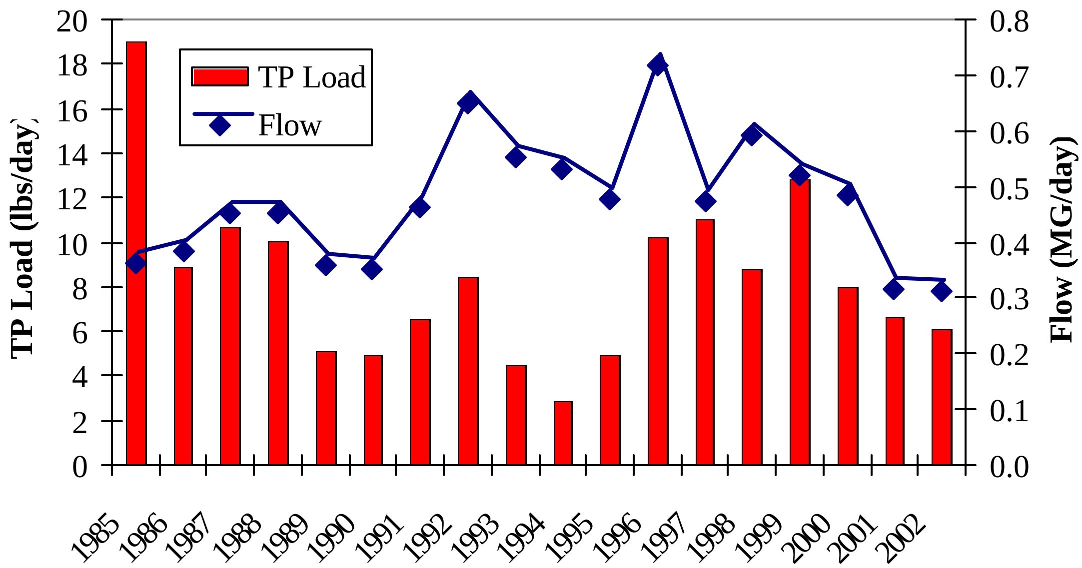


Figure A-12. Mean daily total phosphorus load and flow for Emmitsburg treatment plant.

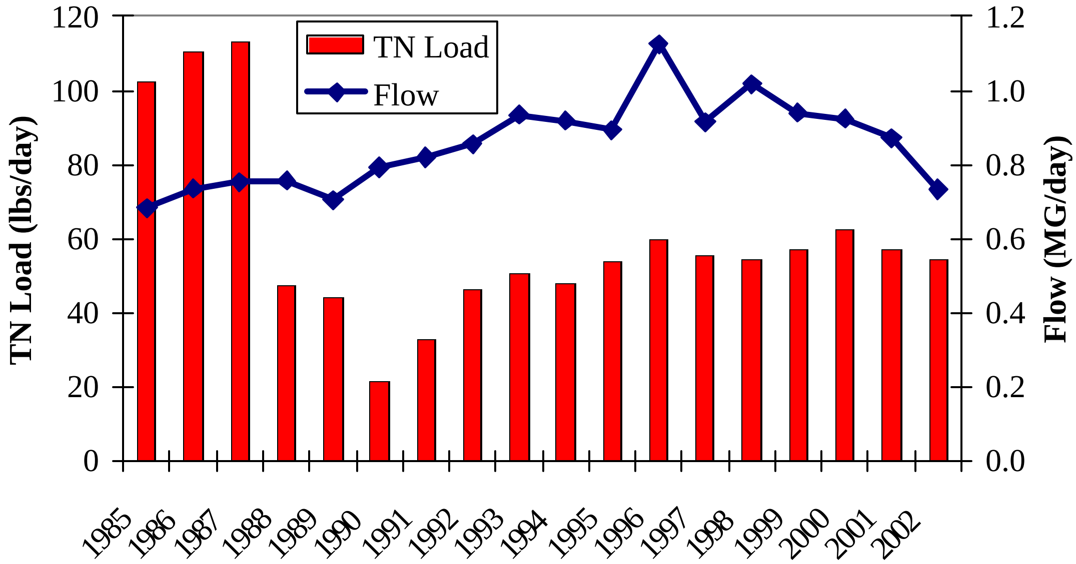


Figure A-13. Mean daily total nitrogen load and flow for Fort Detrick treatment plant.

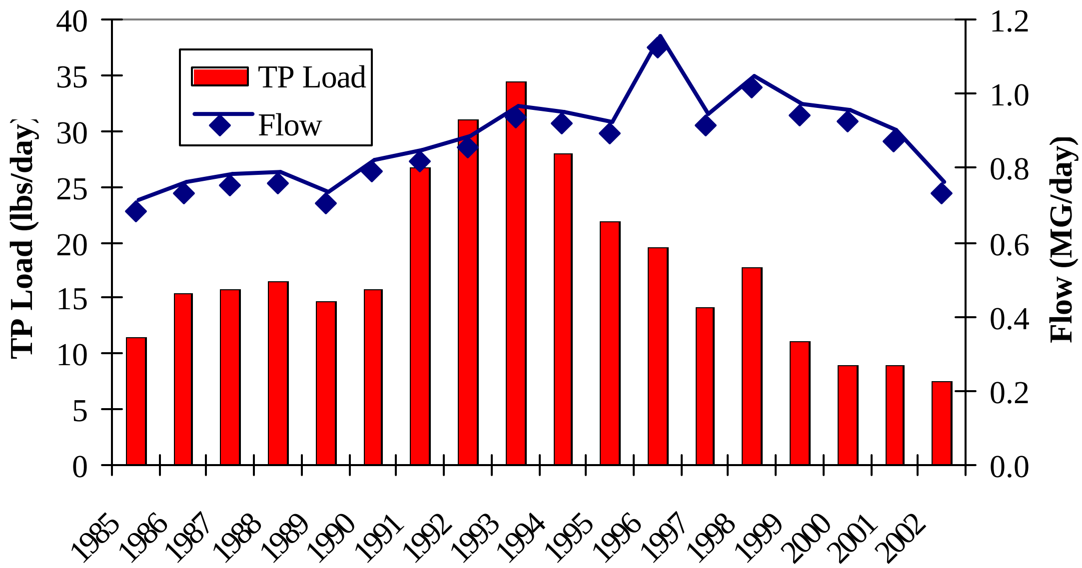


Figure A-14. Mean daily total phosphorus load and flow for Fort Detrick treatment plant.

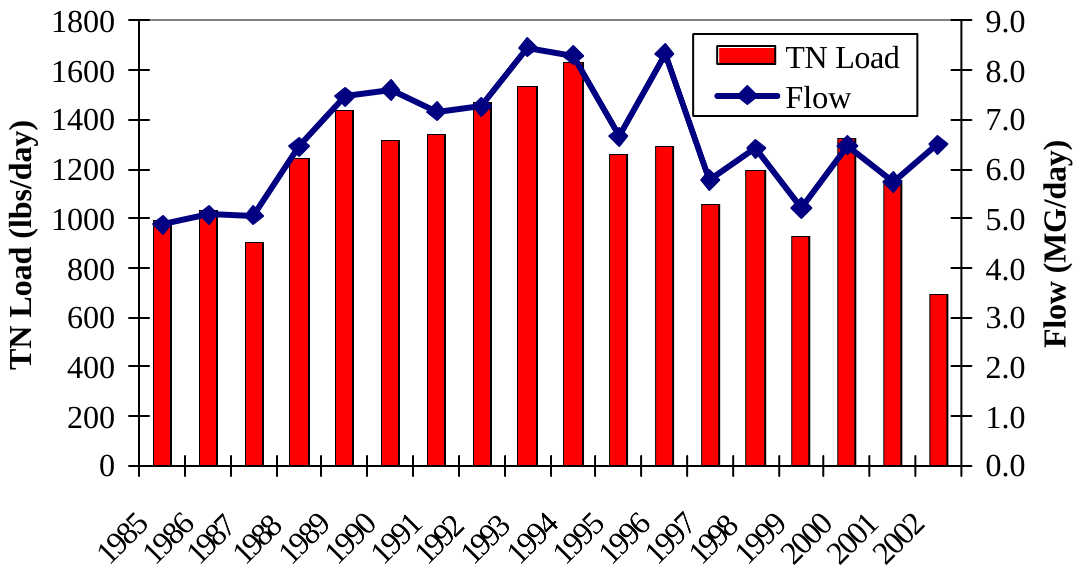


Figure A-15. Mean daily total nitrogen load and flow for Frederick treatment plant.

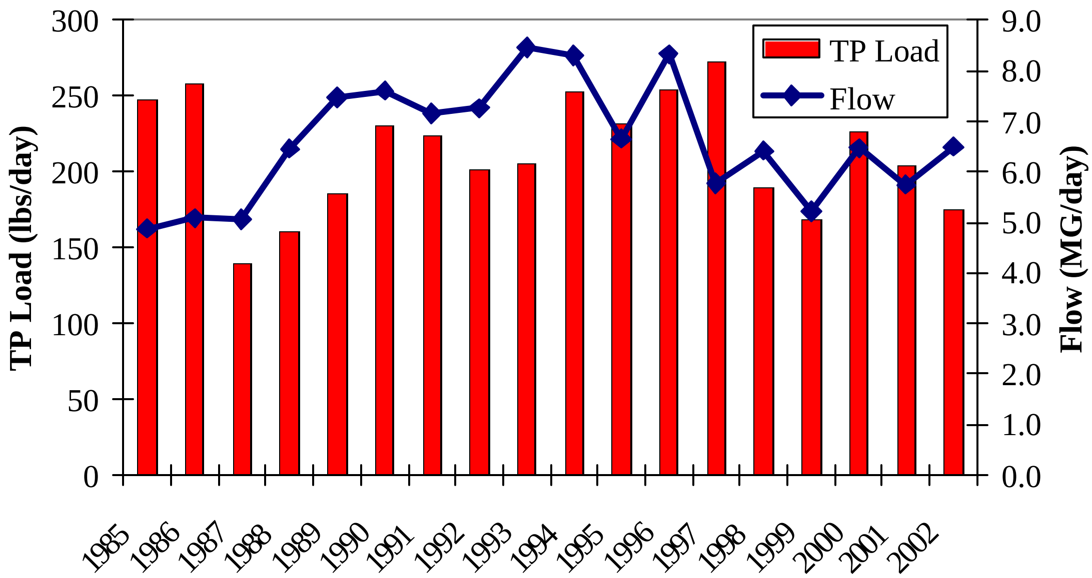


Figure A-16. Mean daily total phosphorus load and flow for Frederick treatment plant.

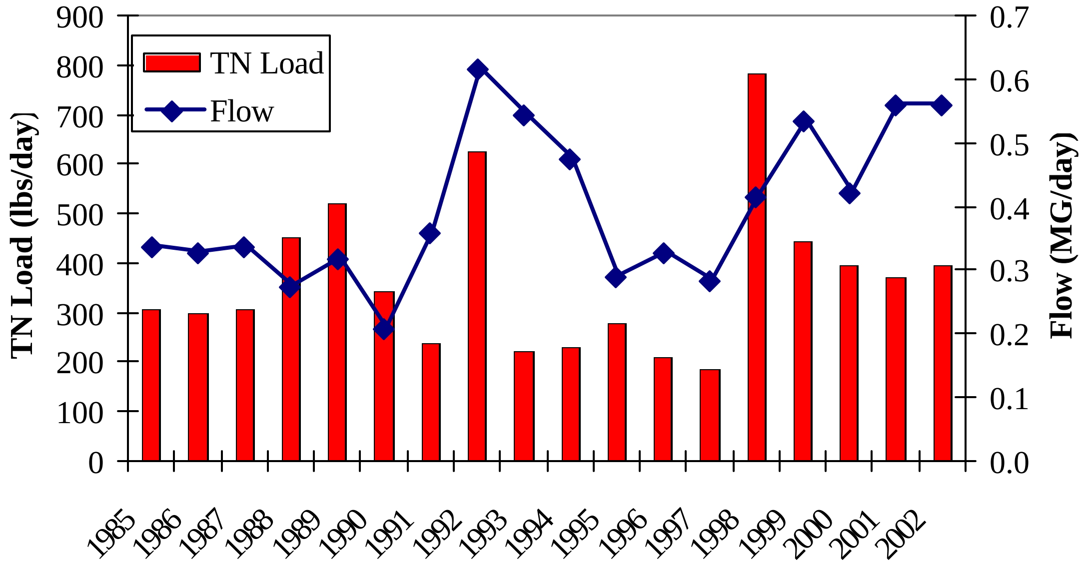


Figure A-17. Mean daily total nitrogen load and flow for Garden State Tanning treatment plant.

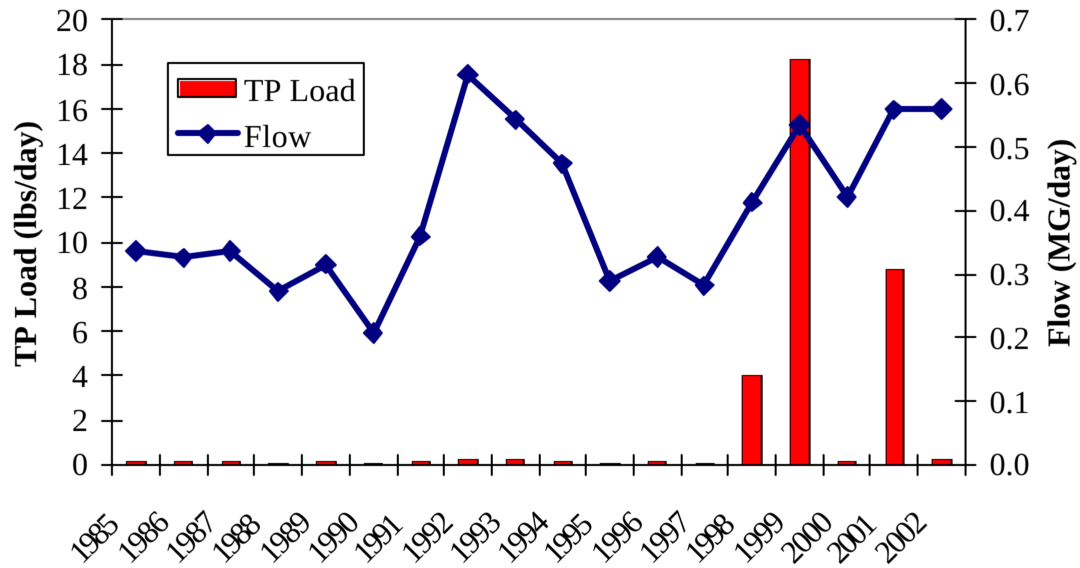


Figure A-18. Mean daily total phosphorus load and flow for Garden State Tanning treatment plant.

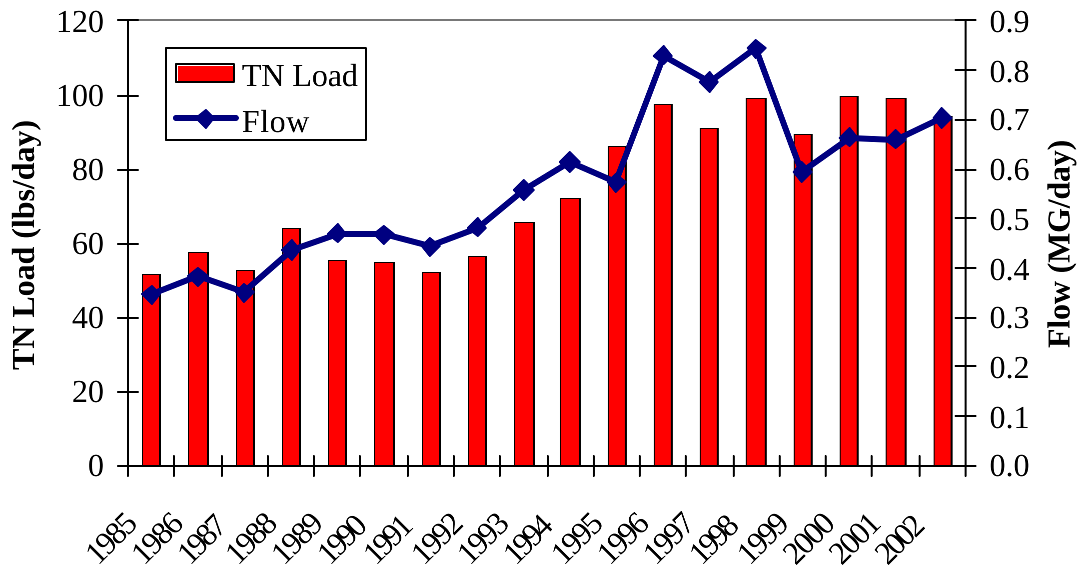


Figure A-19. Mean daily total nitrogen load and flow at Georges Creek treatment plant.

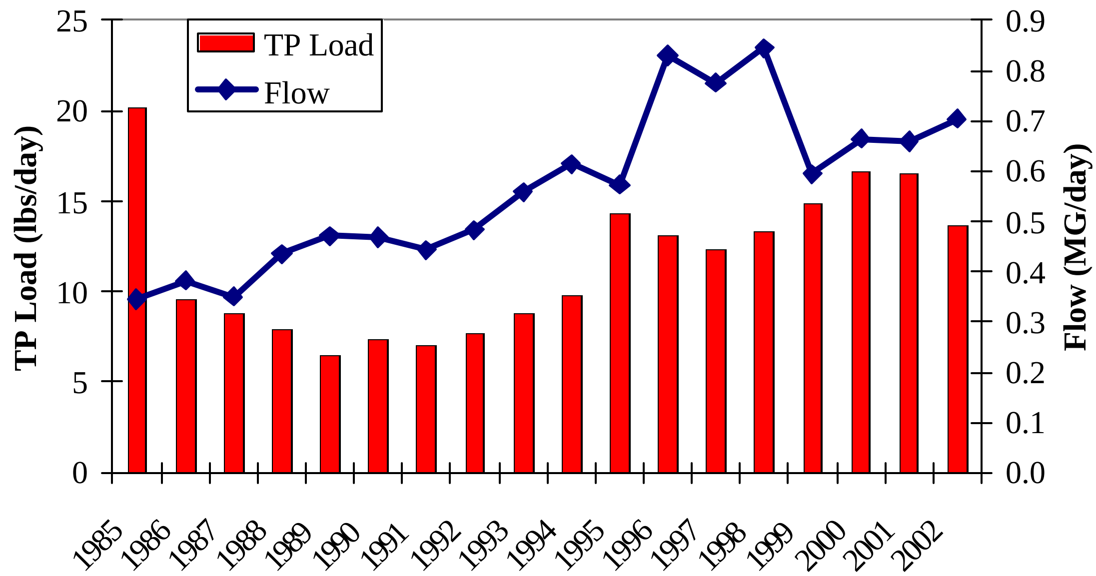


Figure A-20. Mean daily total phosphorus load and flow at Georges Creek treatment plant.

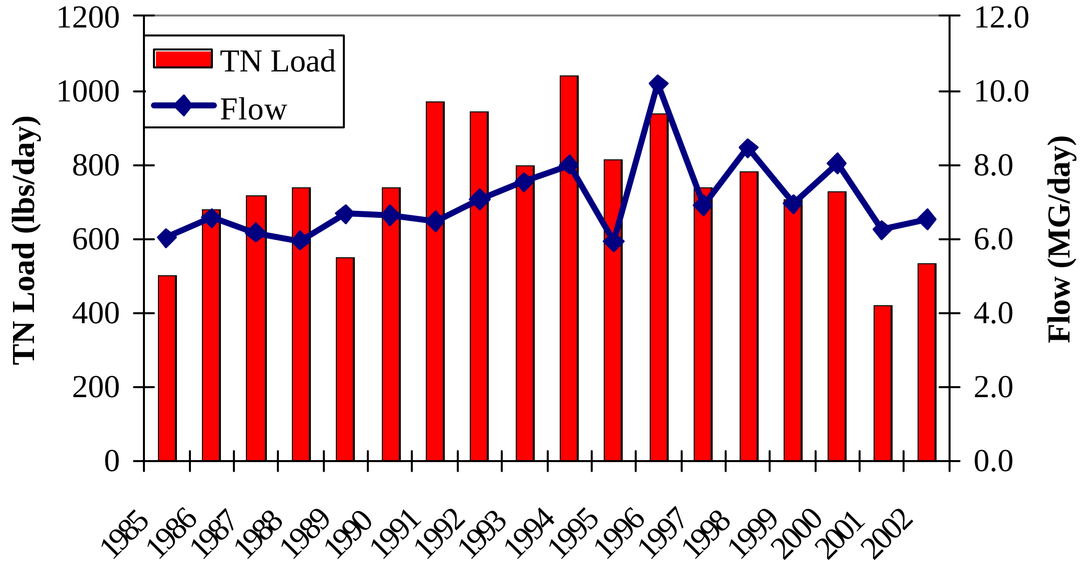


Figure A-21. Mean daily total nitrogen load and flow for Hagerstown treatment plant.

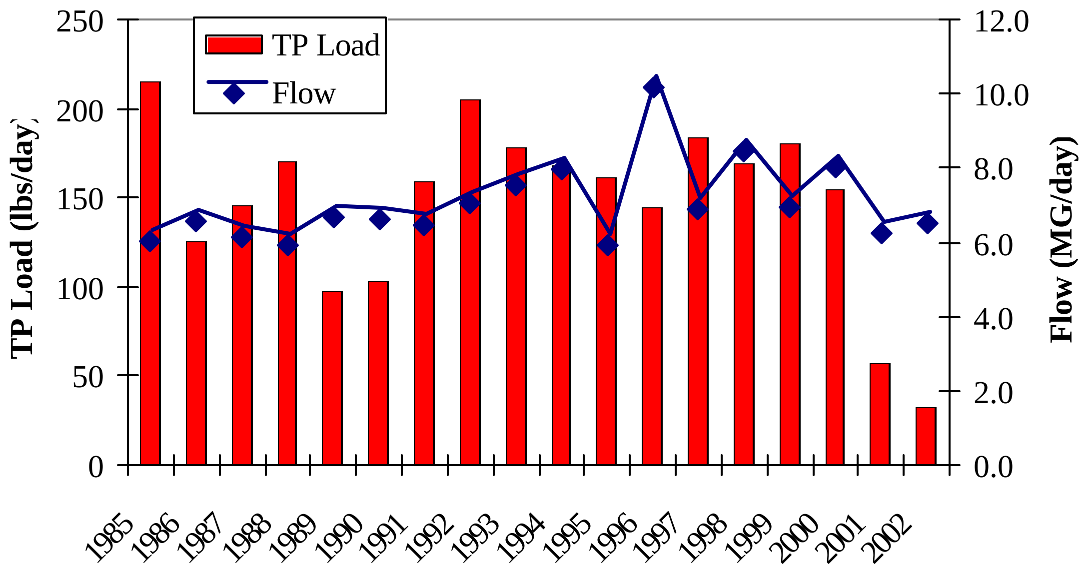


Figure A-22. Mean daily total phosphorus load and flow for Hagerstown treatment plant.

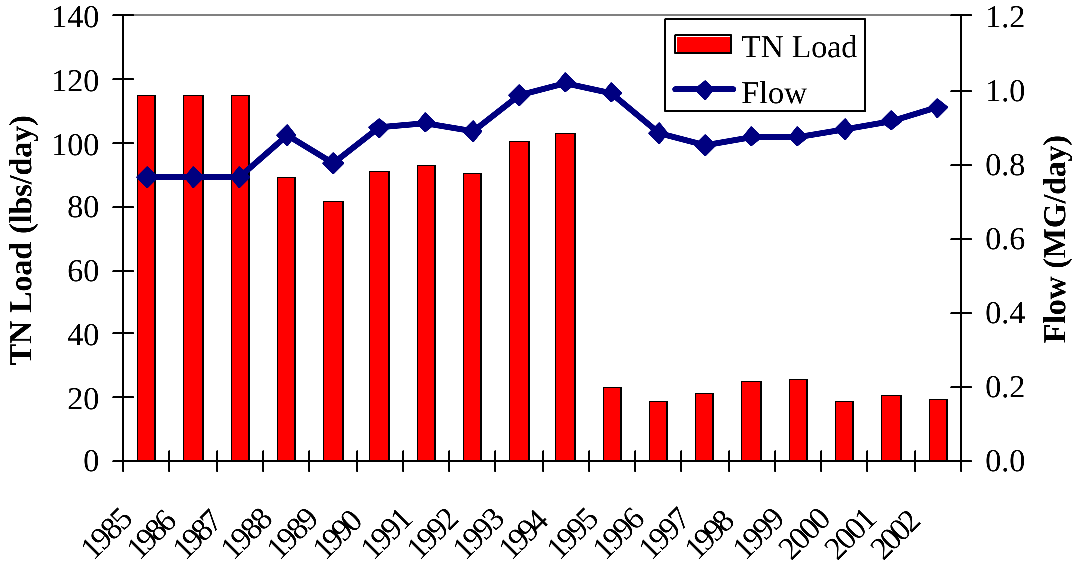


Figure A-23. Mean daily total nitrogen load and flow for MD Correctional Institute treatment plant.

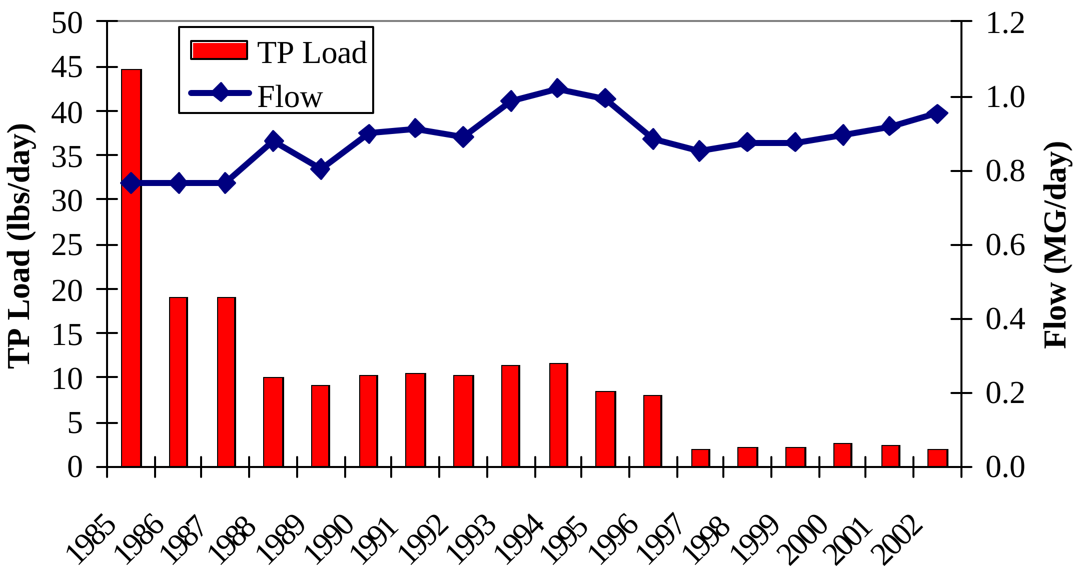


Figure A-24. Mean daily total phosphorus load and flow at MD Correctional Institute treatment plant.

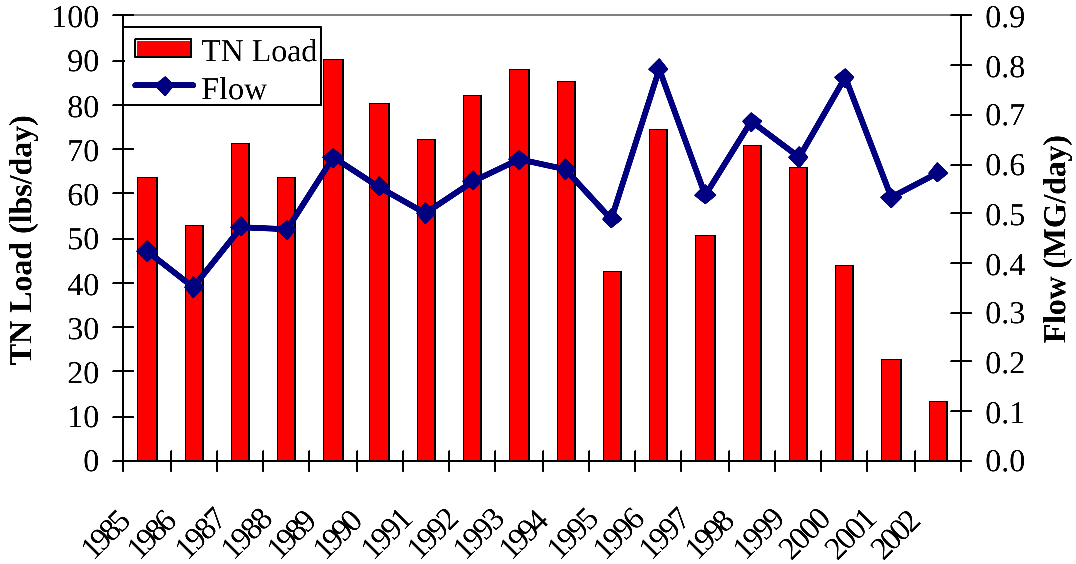


Figure A-25. Mean daily total nitrogen load and flow for Taneytown treatment plant.

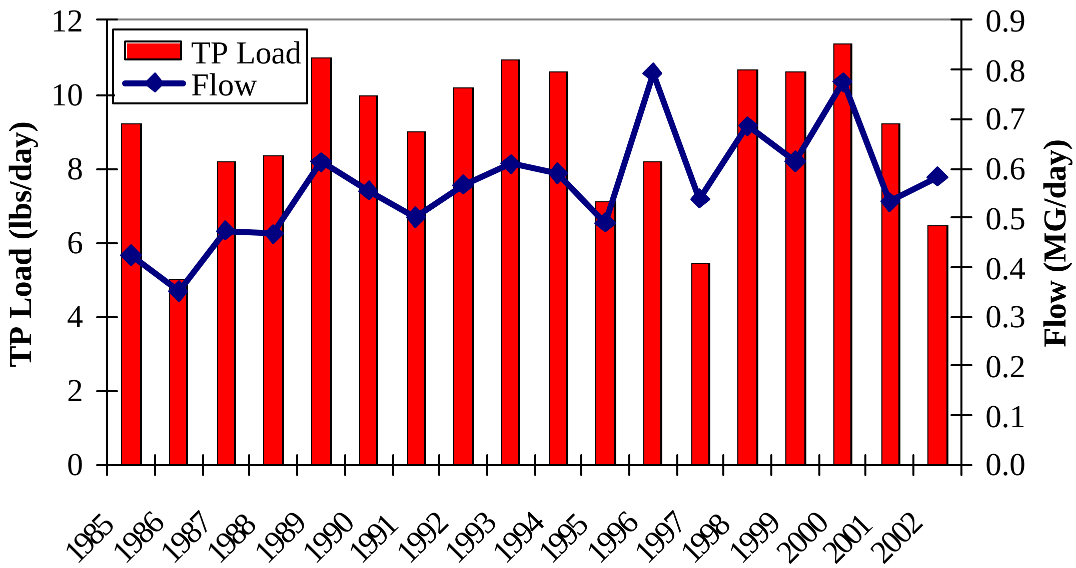


Figure A-26. Mean daily total phosphorus load and flow for Taneytown treatment plant.

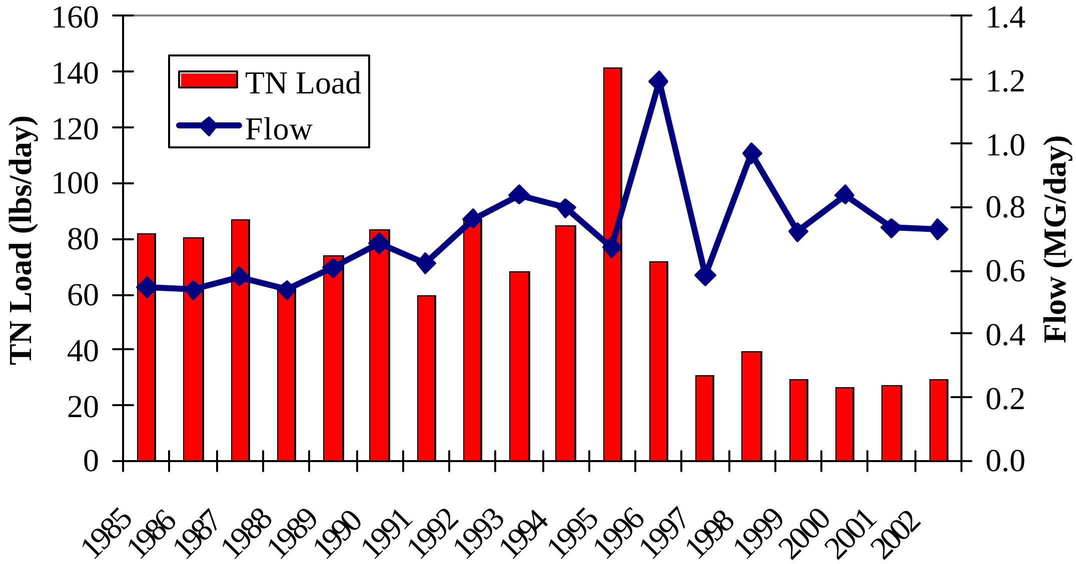


Figure A-27. Mean daily total nitrogen load and flow for Thurmont treatment plant.

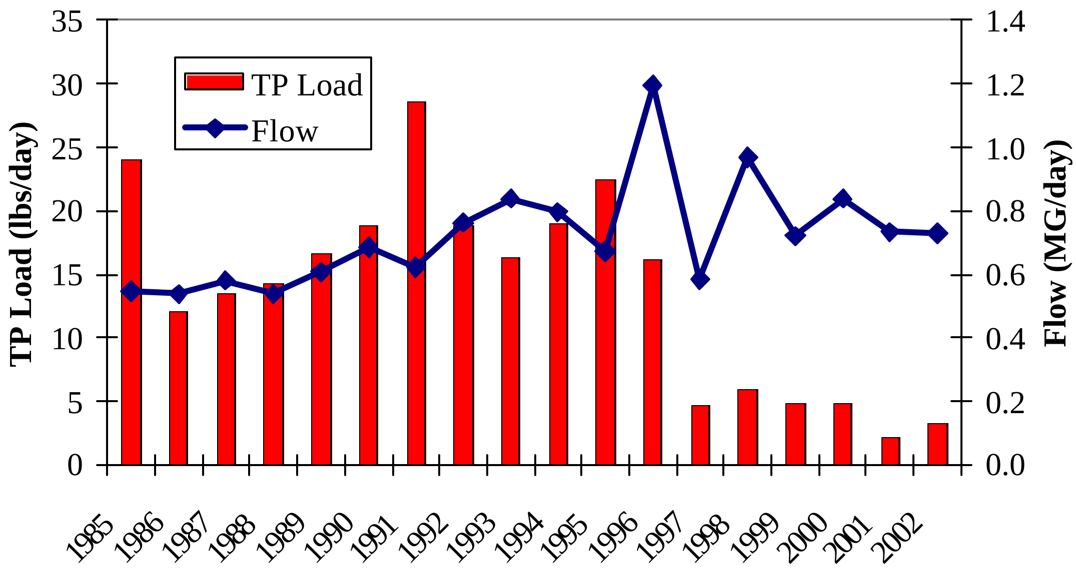


Figure A-28. Mean daily total phosphorus load and flow for Thurmont treatment plant.

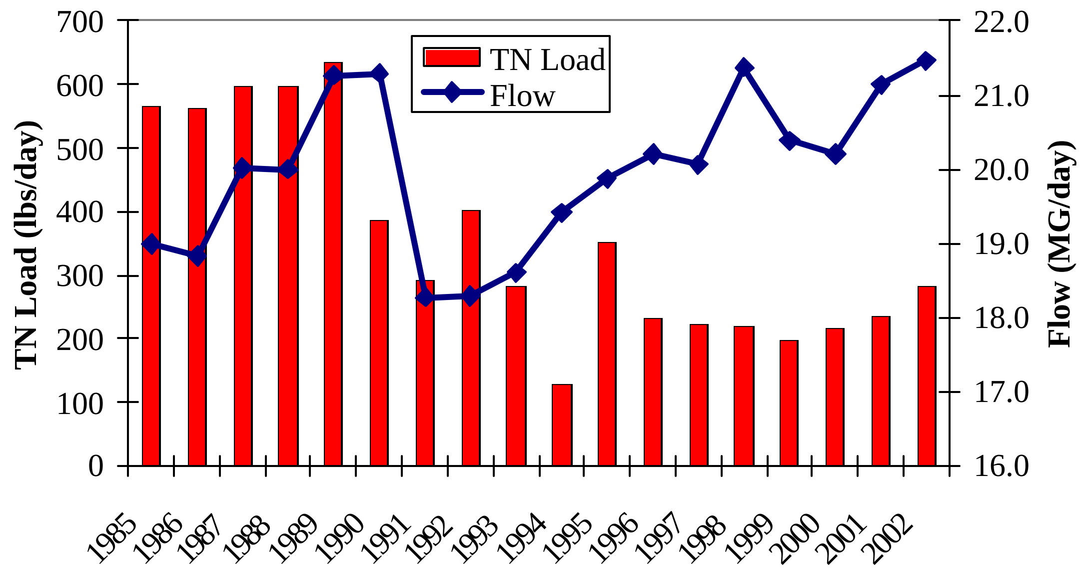


Figure A-29. Mean daily total nitrogen load and flow for Upper Potomac River Commission treatment plant.

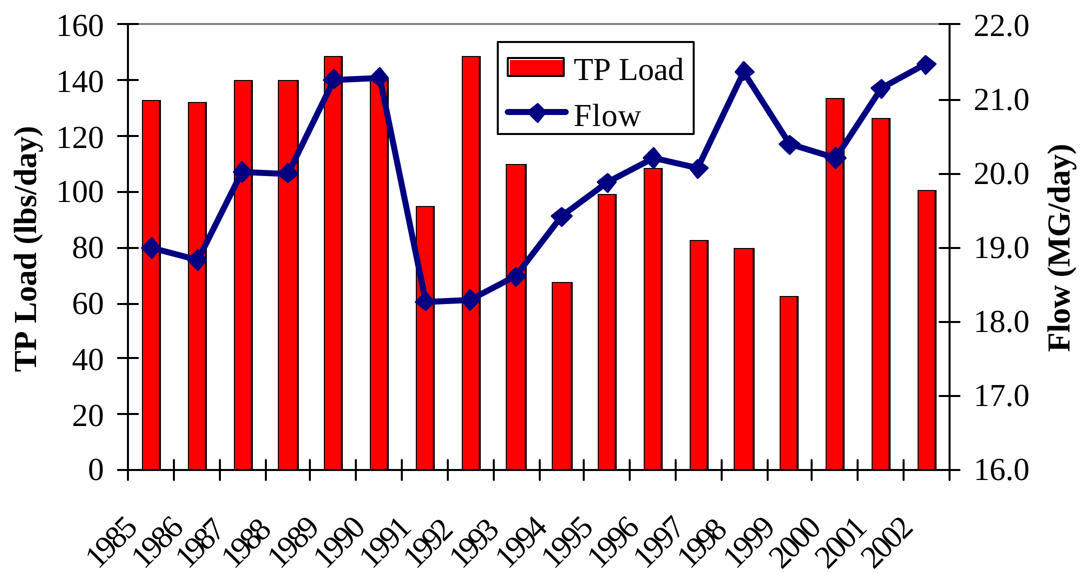


Figure A-30. Mean daily total phosphorus load and flow for Upper Potomac River Commission treatment plant.

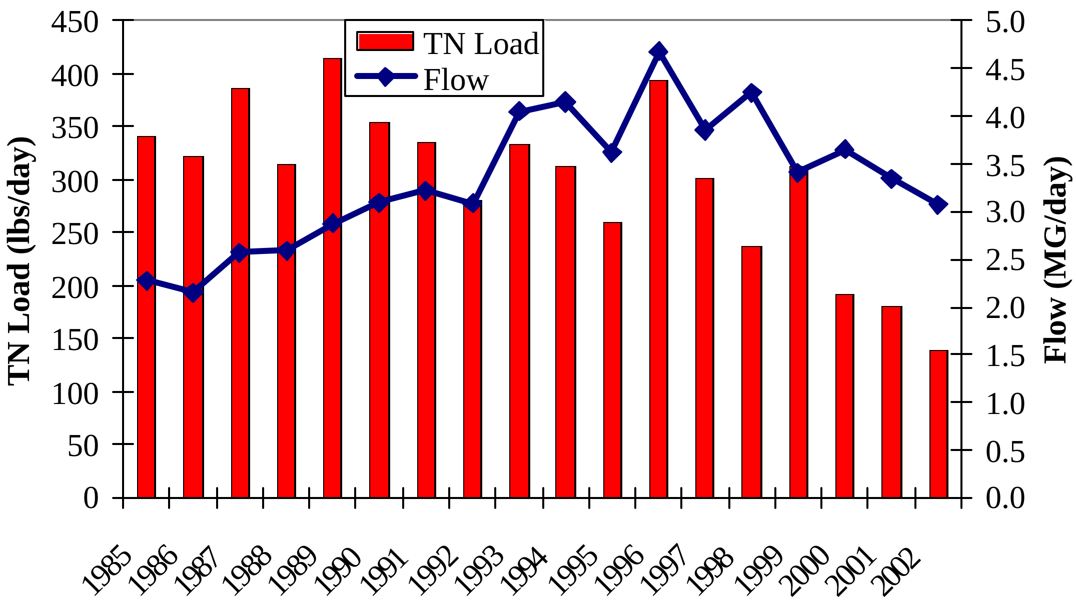


Figure A-31. Mean daily total nitrogen load and flow for Westminster treatment plant.

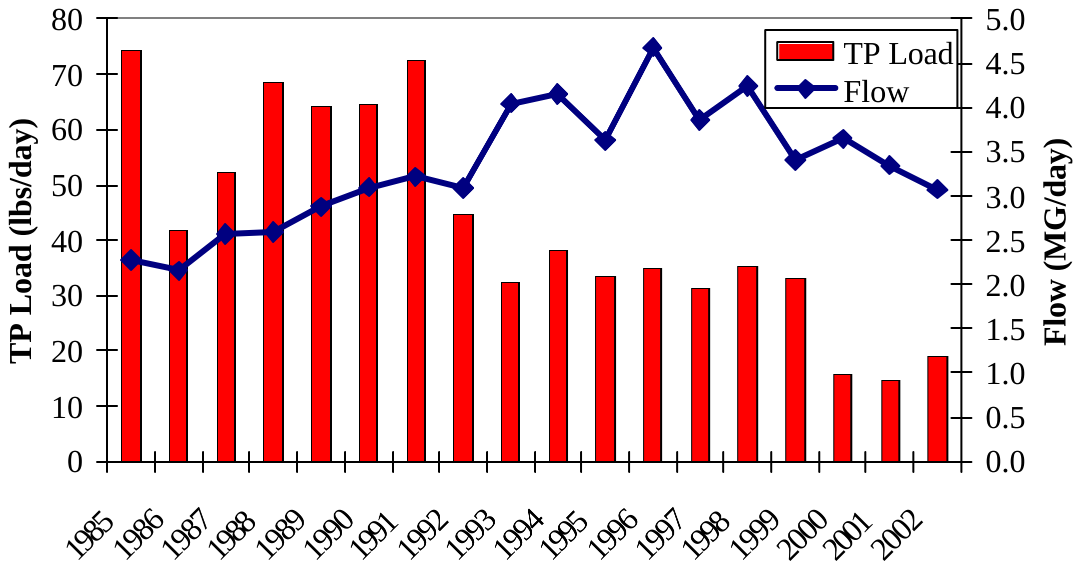


Figure A-32. Mean daily total phosphorus load and flow for Westminster treatment plant.

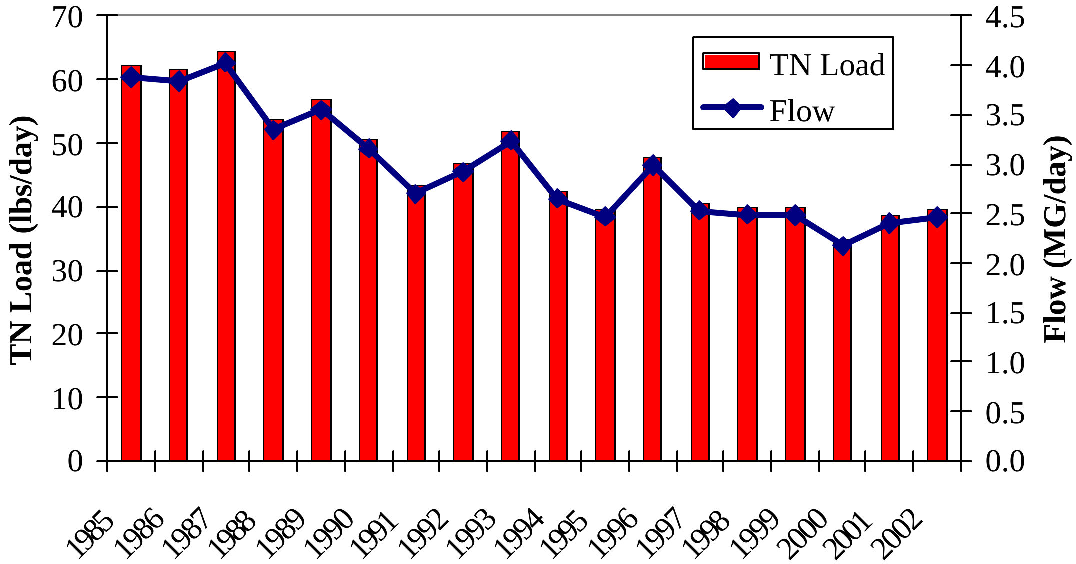


Figure A-33. Mean daily total nitrogen load and flow for Westvaco Corporation-Luke treatment plant.

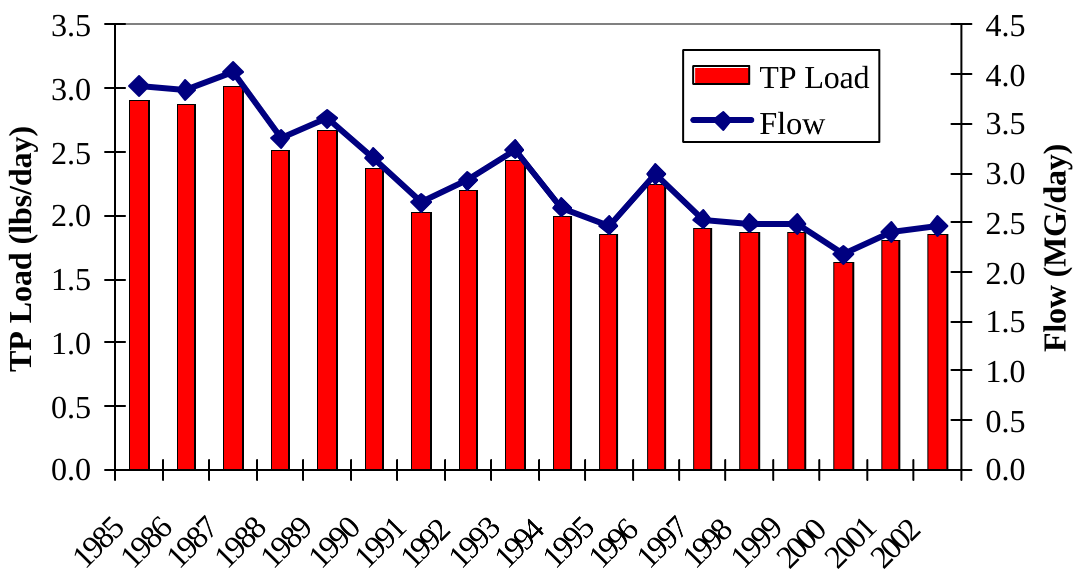


Figure A-34. Mean daily total phosphorus load and flow for Westvaco Corporation-Luke treatment plant.

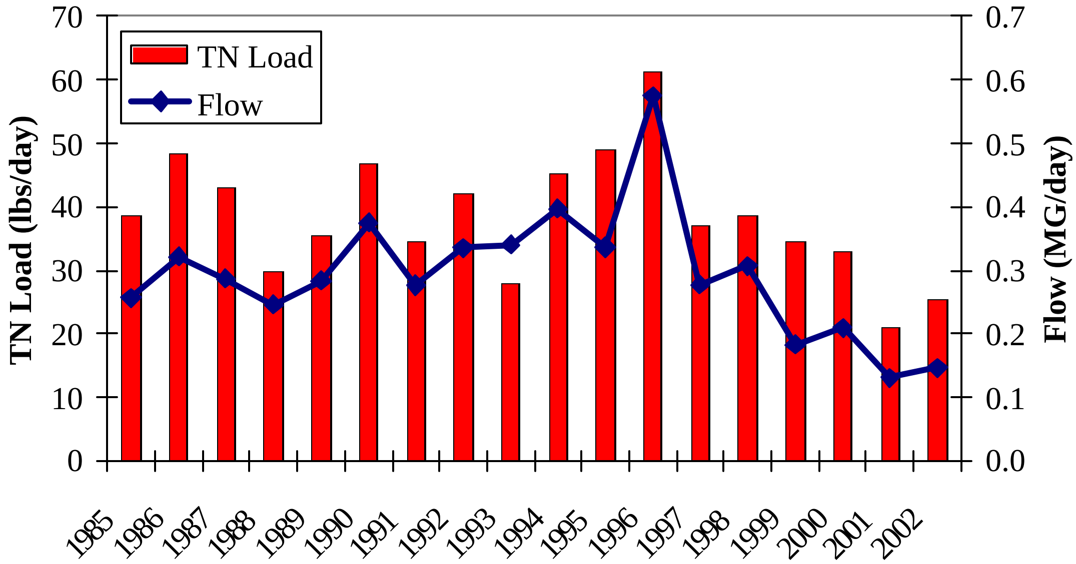


Figure A-35. Mean daily total nitrogen load and flow for Winebrenner treatment plant.

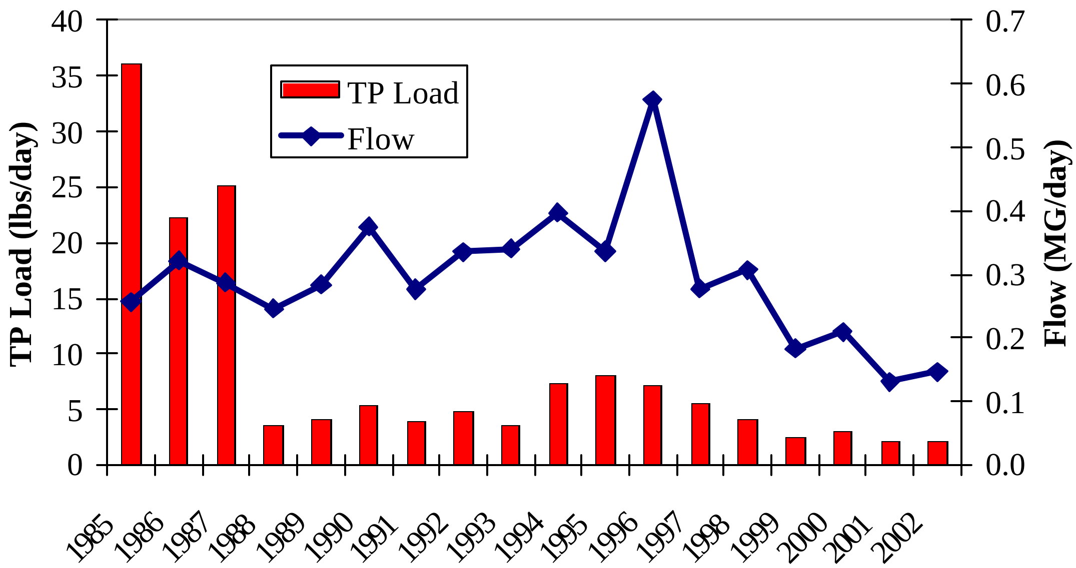


Figure A-36. Mean daily total phosphorus load and flow for Winebrenner treatment plant.

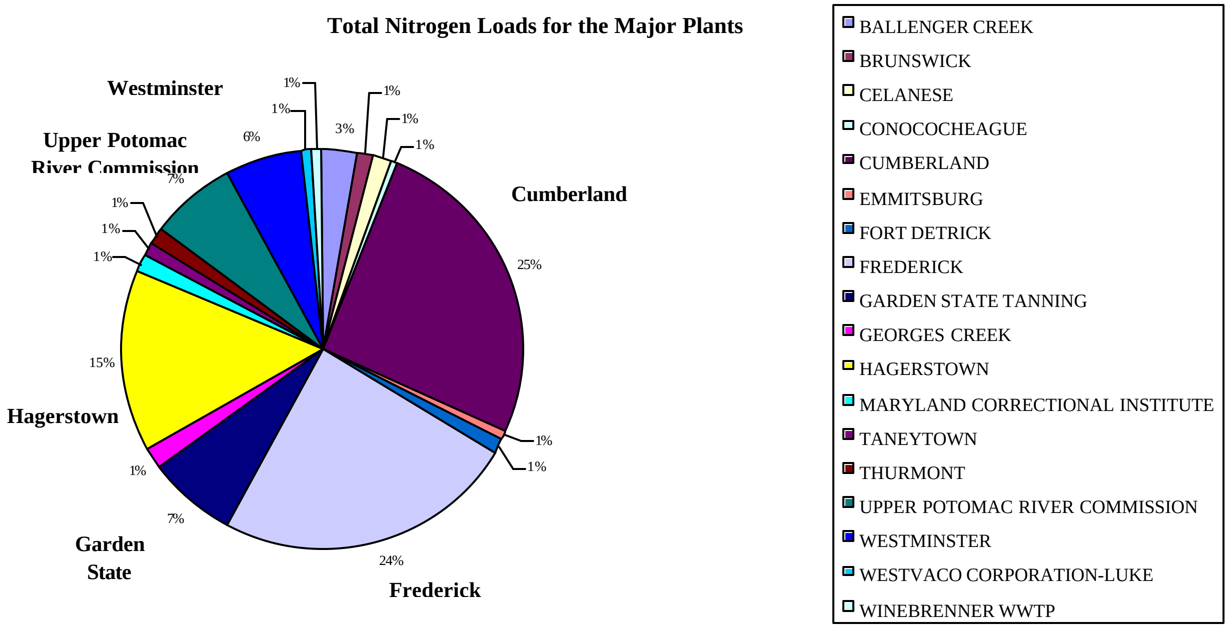


Figure A-37. Percent of total nitrogen load discharged by major plants.

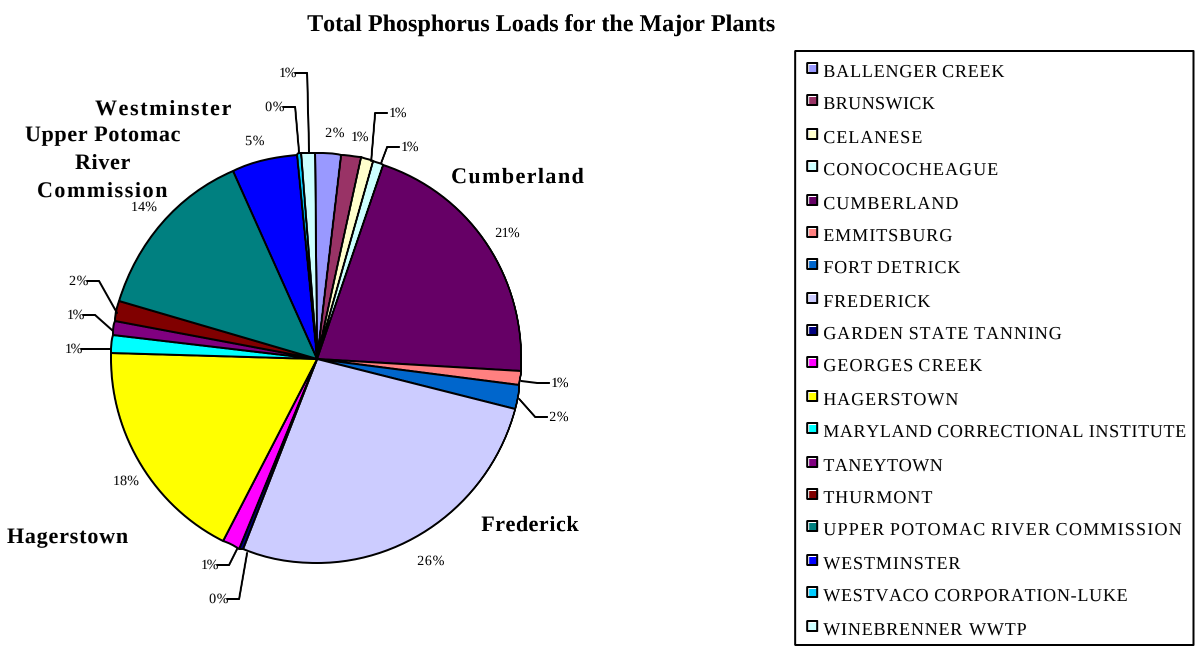


Figure A-38. Percent of total phosphorus load discharged by major plants.

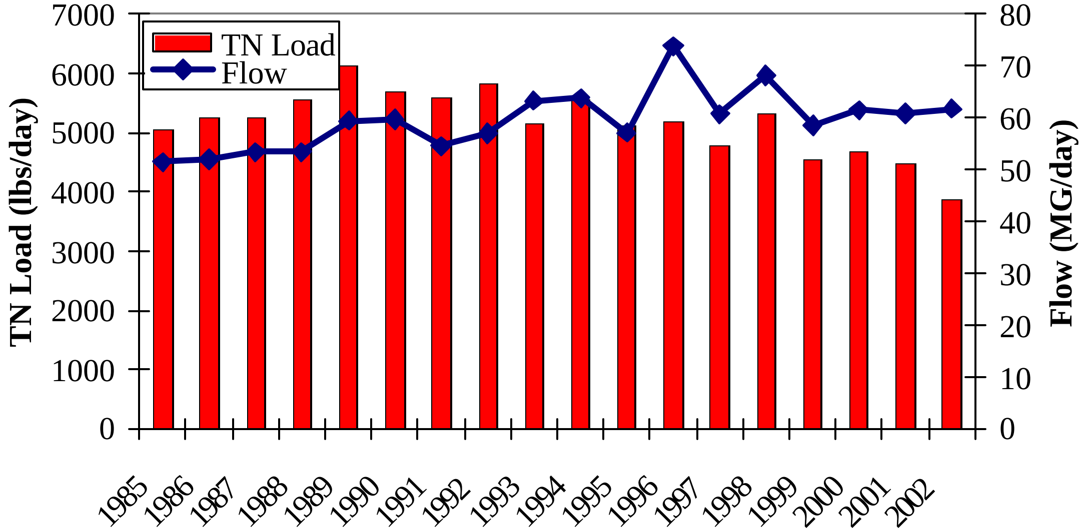


Figure A-39. Total nitrogen loads and flow for all major treatment plants.

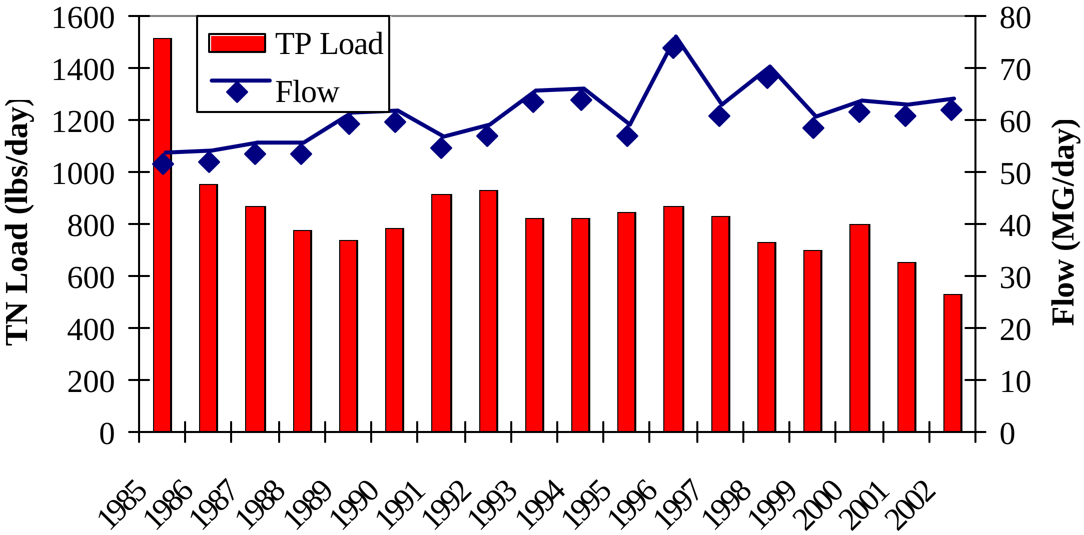


Figure A-40. Total phosphorus loads and flows for all major treatment plants.